EARLY STEPS IN HUMAN PROGRESS

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BY

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FOREWORD

Curiosity is an attribute of the human race. This is fortunate, since it has caused men to probe into the secrets of Nature, and to discover how to harness her forces to minister to their convenience and happiness. A like curiosity causes many to wonder how there arose the varied elements that go to make up our civilization. An attempt to satisfy this curiosity is the purpose of this volume.

Much of the matter set out in the following pages cannot claim originality, for many papers and monographs have appeared, dealing with the early history and development of a number of arts and crafts. Nevertheless, even the specialist may find here some details not hitherto described, or some new ideas as to certain intermediate stages about which direct evidence is lacking.

In many cases archæology has furnished us with evidence for most of the stages in the evolution of a craft. In some we need to have recourse to the methods still employed by backward peoples, trusting that our forefathers passed through stages of civilization not very different; in such cases we sometimes gain a little help from tradition or folklore, or from some ceremonial practice that has enshrined a custom of earlier years. To complete the picture, however, we need nearly always to have recourse to hypothesis, and such hypotheses should receive only provisional acceptance. They may serve, however, as an inspiration towards the search for further facts that may prove or refute them.

A case of confirmation has come to light since the following pages were printed. On page 140 I have suggested that the teepee was used in Mesolithic times. On September 6th Mr. F. Buckley reported to a meeting of the British Association that he had found a number of chipping-floors belonging to the Tardenoisian industry, circular in form but of small diameter, suggesting that these people used small wig-wams, which they moved after occupying the site for a very brief time.

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EARLY STEPS IN HUMAN PROGRESS

CHAPTER I

ALL SORTS AND CONDITIONS OF MEN

In our walks abroad we meet with many men and women and all of them are different. This is not solely due to individual peculiarities, but, if we are observant, we shall notice that some are tall and others short, some are fair while others are dark, in some cases the hair is curly and in others straight. The farther we travel the more noticeable are these variations, until in the Far East we find the skin has a yellowish hue and the eyes are unlike those to which we are accustomed, while as we journey south towards tropical Africa the tint of the skin grows darker until it assumes a black hue in the Congo forests, and the progressive darkening of the skin is accompanied by an increasing curliness in the hair. Thus it is clear that there are many varieties of human beings, sometimes sharply contrasted with one another, more often passing by gentle gradations from type to type.

These varieties are usually called races, or sometimes types, and are in some respects similar to the breeds of horses, cattle, dogs, cats and poultry, save that the latter have usually been produced by artificial selection under human guidance, while the races of men

are due solely to natural causes. At first people were prone to distinguish these races apart only by the colour of the skin, and spoke of the black Negro race of Africa, the yellow or Mongol race of East Asia and the Red Man of America. We know now that the colour of the skin is by no means always the best criterion of race, for it varies much among individuals in the same race, and in the same individual at different times according to age and the degree of recent exposure to the rays of the sun. There are other characters that are equally if not more important, though not always so readily apparent, and it is upon an aggregate of such characters that the definition of a race must depend. The chief of these characters are stature, pigmentation, head form, facial features and hair, though there are other minor characters that are sometimes of importance.

While stature is to some extent an individual trait, depending to a certain degree upon health and nutrition during the years of growth, nevertheless there are races, members of which are habitually tall, though short individuals occur. Other races are short—some so small as to be reckoned pigmies. Still, in spite of individual variations, two fairly large samples from the same race would probably have the same average stature, and differ, in this respect, from similar samples taken from members of other races. In stature, however, we must not reckon only the height, but the girth and, above all, bodily proportions. Thus some races are spare and bony, while others tend to be thick-set and corpulent, while the length of the neck is very variable and seems to be a racial rather than an individual character.

Colour, or pigmentation as it is called, is a surer guide to racial distinction, and this is of three kinds,

the colour of the skin, the hair and the eyes. All races have pigment cells beneath the skin and these produce tints, varying from brown to black, according to their size and number. In some individuals the pigment cells are very few in number, and in these cases the complexion varies from white to pink or yellow according to the thickness of the skin. Thus a very thin skin shows the small blood vessels beneath it, and so produces a pink shade, while a very thick skin produces a sallow complexion, varying from yellow to a dull parchment hue. Relatively light pigmentation, accompanied by a thin skin, gives a reddish-brown colour, and thus from these two features, pigment cells and the thickness of the skin, a great variety of shades can be derived.

The pigments that colour the hair are less well known. The colour depends not only on the pigment but on the amount of air in the interior of the hair. It is believed that red hair is an individual rather than a racial character, and it has been noted that it occurs more frequently in regions where dark and fair haired types have mingled. The iris of the eye is usually brown or black, but light eyes, grey or blue, are common in the northern parts of Europe and occur with less frequency elsewhere on the continent and in the neighbouring parts of Asia and Africa; elsewhere these light tints are unknown. The distribution of light eyes suggests that originally it was associated with fair hair and a relatively unpigmented skin.

Most anthropologists believe that the form of the skeleton provides the surest indication of race type, and that among the bones none are of so great importance as those of the skull. The shape of the skull is believed to be all important and less liable to variation due to climate and other environmental influences. For long it has been customary to class skulls as long

and narrow or short and broad, by measuring the extreme length from the forehead to the bump at the back, known as the occipital protuberance, and again the greatest breadth. The proportion between the length and breadth, taken in this way, gives an index, which, it is thought, is a valuable clue to racial affinity. Thus if the breadth is less than 80 per cent. of the length the skull is classed as long-headed, or *dolicho-cephalic*, while if it is 80 per cent. or upwards it is called broad-headed or *brachy-cephalic*. Another valuable index is the proportion between the greatest breadth and the height above the ear-holes.

At one time it was the fashion to measure in this way the heads of a large number of people in a given region and to work out the average length-breadth index of the whole and from this to draw conclusions. This method has been found to be far from satisfactory, since the people may be, in fact almost certainly are, made up of individuals of two or more racial types, while the average index obtained is not that of any of these but a compromise between them all. A better plan, now generally adopted, is to plot out the numbers to show a frequency curve.

Then, if the curve shows a single apex with fairly symmetrical sides, we may conclude that the racial strain is approximately pure, while if there are several apices, or considerable bulges on one side or the other of a single apex, we may conclude that there has been some admixture and form some opinon as to the racial elements of which the people are composed.

The length-breadth index is of itself insufficient to tell us all we need, nor is it enough only to add the height-breadth index. Much depends upon other details, especially upon the position of the greatest breadth. Thus many people of North Europe have a length-

a. Mongol

b. Negro

c. Ainu

d. Bushman

PLATE I. FOUR RACIAL TYPES

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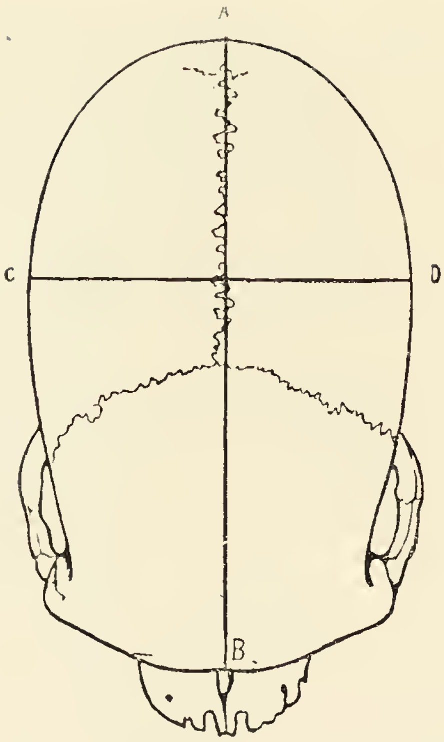
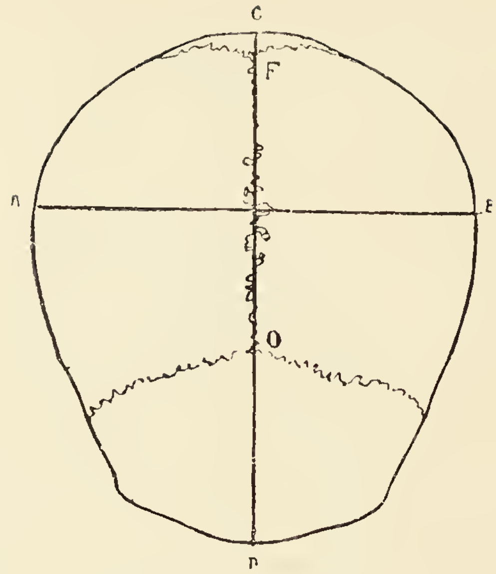
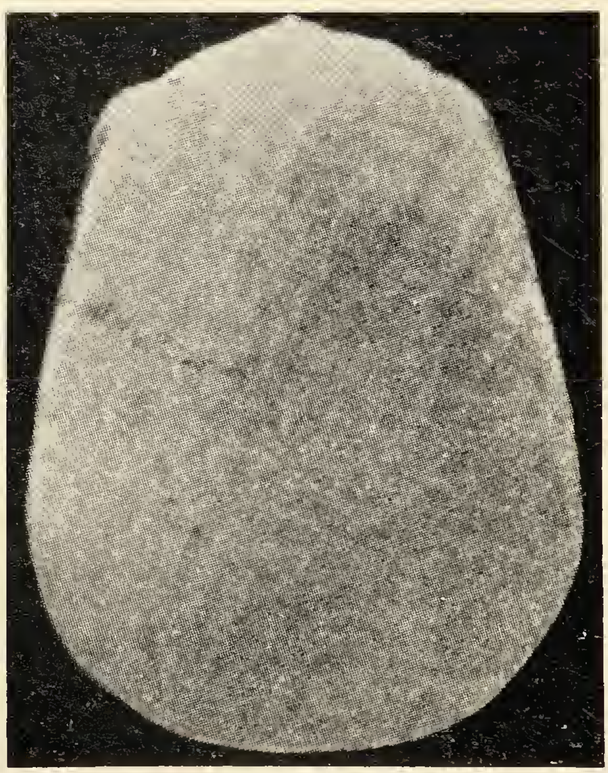


a. Long and narrow



b. Short and broad

c. Long with medium width



d. Long with broad occiput

PLATE II. FOUR SKULLS AS SEEN FROM ABOVE

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readth index of about seventy-eight. In most of these ases the greatest breadth is near the back of the head, hile among some it is immediately over the ears. his difference in the position of the greatest breadth ppears to be of considerable significance.

The facial bones of the skeleton are also of import- ice, and it is these that have much influence upon the hysiognomy or general appearance of the face. A very nportant feature is the proportion between the length id breadth of the face. Usually types with long narrow eads have long and narrow faces, and the opposite true of broad-headed types. Sometimes, however, is is not so, and a short and broad face accompanies a ng narrow skull. This is looked upon as a disharmony, id some suspect that it is a feature due to long-estab- shed cross-breeding. It is, at any rate, a character of e populations of some regions.

The nose is another valuable indication of race, and s most important variation is the proportion between s length, from the forehead to the upper lip, and its idth at the base. This can be determined in the living bject and by measuring the nose opening in the skull. hese two series of measurements are not, however, bsolutely comparable, though approximately so. The ape of the profile is also important, for straight, convex high, and concave or retroussé noses are character- ic of different races. These can rarely, except in the se of the convex nose, be detected with precision in e skull.

Eye sockets like noses can be long and narrow or oad and short, and may be horizontal or slightly wer on the outside. The *zygomae* or cheek bones ow unusual width in some races, while the strength the brow ridges is an important feature in others, pecially among the males. There are other minor

differences, noted by anthropologists, which may or may not have racial significance and so need not detain us here.

A word, however, must be said about the jaws, for these frequently show characters very distinctive of race. If we look at the profiles of some people, especially Europeans, we shall find that a straight line drawn along the forehead touches the base of the nose, the teeth and the tip of the chin. Such a face is termed *orthognathous*, and the great majority of Europeans and some peoples elsewhere conform very nearly to this standard. It is quite different elsewhere. Among many peoples, especially in tropical Africa, such a line would leave the base of the nose, the teeth and the chin projecting far in advance; the whole jaw projects in front of the face. This is called *prognathism.* A modified form of this is where the teeth and the gums only project beyond the line. This is termed *alveolar prognathism*, and is a common feature among the people of North Africa and can be noticed not infrequently in South Europe.

We have already dealt with the colour of the hair; we must now turn to its texture. Hair may be straight, wavy, frizzy and woolly, and almost every intermediate condition may be found. In Europe we meet mostly with straight and wavy hair, but individuals may sometimes be found with hair that can almost be called frizzy: this is, however, unusual. What these different types of hair look like will best be understood by studying the accompanying illustrations. These different qualities are due to the shape of the section of the hair, which is circular when the hair is straight, oval when it is wavy, a flatter oval when it is frizzy, while it is quite flat like a ribbon where the hair is woolly. Some anthropologists believe that the nature of the hair is

the best means of distinguishing racial types, and have classified the races of men in the first instance by this character. While this may be laying over-emphasis upon one character, and that perhaps by no means the most important, the section and nature of hair is undoubtedly a valuable aid to distinguishing races. Straight hair is found mostly in northern Asia and America, woolly hair among the much pigmented peoples of the tropics, wavy hair is very noticeable in North Africa and around the Mediterranean Sea. All types, however, are found outside the regions mentioned.

These, very briefly enumerated and described, are the chief physical characters that serve to distinguish one racial type from another, but it must be remembered that besides the well-marked types there are others that show intermediate characters, while there are large numbers of individuals that exhibit some features of one type with others more often associated with a different race. Man has been on the earth for a very long time, during which he has wandered considerably, more especially in his early days, when he depended for his food on hunting, and during the last few centuries, when improved means of transport have made travel easy and pleasant. It is small wonder, therefore, that during this long time, during which racial types have been evolving in regions of relative isolation, the wandering proclivities of man have caused so much interbreeding, in spite of many efforts, such as the caste system, to restrict it, that few individuals to-day can be considered as racially pure. It is more strange that some individuals do exist, who show in their outward appearance no visible signs of such admixture.

In the middle of the nineteenth century a view was current in some quarters that mankind was not all derived from the same stock. It was felt by some that

the negro and the white man could not be descended from the same ancestors. This view, known as the polygenetic theory, was widely held and as actively combated in other quarters. At last the adherents of the monogenetic theory prevailed, and it is now generally believed that all men living at the present day, since they are all fertile *inter se*, are descended from the same group of ancestors, and are the same species, *Homo sapiens*.

Quite recently there has been a revival of the polygenetic theory, and the view has been advanced that different types of men have evolved from the three species of great apes, the Gorilla, the Chimpanzee and the Orang-utan. Though this view has been argued with great ability, it has not received any serious support in this country, though it has, I believe, found some favour in Germany.

Although, however, all men living to-day can be considered as members of a single species, of which there are varieties, races or breeds, like breeds of dogs, though they do not differ from one another to anything like the same extent as a bull-dog differs from a greyhound, yet we have ample evidence, and this evidence is yearly growing in bulk, that this was not always so. At a time, not so very far distant, for it can be measured in a relatively few thousand years, there were other human species and, indeed, other *genera* that deserve to be ranked as men. Remains of these extinct species have only come to light during the last eighty years, but they are now so numerous and so varied that we must defer the discussion of the problems connected with them to the next chapter.

a. Straight hair

b. Wavy hair

c. Frizzy hair

d. Woolly hair

PLATE III. DIFFERENT TYPES OF HAIR

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a. Gibraltar skull: profile

b. Gibraltar skull: front view

c. Peking skull: profile

PLATE IV. GIBRALTAR AND PEKING SKULLS

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CHAPTER II

ANCIENT TYPES OF MAN

It was in the year 1856 that some workmen, digging in a cave in the Neanderthal, near Düsseldorf, discovered part of an extraordinary skull, which for a time gave rise to much acrimonious discussion. The fragment was only the roof of the skull and the forehead, but it was distinguished from all modern skulls, and from all others hitherto known, by a very massive ridge, running right across the forehead above the eye sockets. This ridge, known to anatomists as a *torus*, is a normal feature in the skulls of the great apes, especially of the Gorilla and the Chimpanzee, but is not found in the skulls, ancient or modern, of *Homo sapiens*. For a time a lively controversy raged around this skull, and, as Huxley remarked a few years later, "It was suggested that the Neanderthal skeleton was that of a stray idiot: that the characters of the skull were the result of early synostosis or of late gout: and, in fact, any stick was good enough to beat the dog withal." Huxley was first of the opinion that it was but an extreme variant of *Homo sapiens*, but Professor King believed that it was so unlike the skull of a modern man that it warranted a distinct specific name, and called it *Homo neanderthalensis*, by which name the species is still known.

For long it was believed that the Neanderthal skull was the only one known of this species, but some years later it was realised that a skull, found in 1848 by Lieutenant Flint near Forbes Quarry, on the Rock of Gibraltar,

closely resembled it, though the ridge across the forehead was not so pronounced. It was then concluded that the skull was of the Neanderthal type, but that it was that of a Neanderthal woman.

Many more examples of this species have since been found, the best preserved of which is that from the cave of La Chapelle-aux-Saints in France, where a complete skeleton was found. This was fully described by M. Marcelin Boule, and it was ascertained that this skeleton was associated with an industry of flint implements, known as that of La Moustier, an industry that will be described in a later chapter.

Since this discovery remains of Neanderthal man, including those of men, women and children, have been found in many parts of Europe and elsewhere. The remains of a whole family were found between 1899 and 1906 in a cave near Krapina, by the side of the Krapinica, which flows into the River Save. Here Professor Gorjanovic-Kramberger found over two hundred fragments of bone, that had belonged to at least ten individuals of all ages and both sexes. In recent years Mr. Turville Petre unearthed the greater part of the skull of a Neanderthal girl in the Robbers' Cave near the Plain of Gennesaret in Galilee, while a few years later Miss Garrod visited the Rock of Gibraltar, blew up with dynamite some large masses of crystalline rock of recent formation, and extracted therefrom an almost complete skull of a Neanderthal boy of about ten years of age.

A much more perplexing skull is that found in 1907 at Broken Hill in Rhodesia. The skull and such bones as have been preserved show some very primitive characters, and this has led Professor Elliot-Smith to suggest that it is earlier than the people of the true Neanderthal species. Others, however, while recognising the primi-

tive features, are inclined to consider that it is later in date, and that after the majority of the Neanderthal men passed south into Africa, at the oncoming of the Würm glaciation, some survived in a degenerate form in the centre of that continent. Unfortunately the animal bones found with these remains do not enable us to give them even an approximate date.

Some years after the discovery of the Neanderthal skull remains of a much more primitive individual, dating from an earlier time, were found in Java. These were discovered between September, 1891, and October, 1892, by Dr. Eugene Dubois in a deposit by the banks of the Bengawan near the village of Trinil, and consisted of the greater part of the skull, a left thigh bone and three teeth. The skull has a much smaller brain capacity than any human skull known, and is clearly much more primitive and ape-like than that of the Neanderthal man, though it possesses the same heavy brow-ridge or *torus*. Dr. Dubois named the species *Pithecanthropus erectus*, and for long it was hotly debated as to whether the remains belonged to an early form of man or to a gigantic Gibbon. From the animal bones associated with it Dubois claimed it as of late Pliocene date, though it is now usually relegated to the earliest phase of the Pleistocene period. Though no tools were found with the remains nor in the same deposit, most authorities now agree that the bones must have belonged to a human being, who was worthy to be called a man, albeit the most primitive man yet known.

That this decision is correct seems clearly proved by another much more recent discovery. As early as 1903 a fossilised tooth, apparently of a primitive man, was found among a number of "dragon's bones" in a druggist's shop in China. Unfortunately the source

of the tooth could not be ascertained, but in 1919 Dr. J. G. Andersson found a bed of fossil bones in a cave near Chou Kou Tien, thirty-seven miles south of Peking. From the material collected here in 1922 and 1923 Dr. Zdansky extracted two human teeth, details of which he published in 1928. On October 16th, 1927, on the same site another tooth was discovered, a lower molar, and in November, 1928, the excavators found part of a human jaw, besides a number of teeth and a small fragment of the lower jaw of a child. Lastly on December 2nd, 1929, Mr. W. C. Pei discovered in the same deposit the almost complete brain case of an adult skull.

These remains were named *Sinanthropus Pekingensis*, and the deposit in which they were found has been proved to be of early Pleistocene date, much about the same date as the remains from Java, and considerably earlier than those of Neanderthal man.

The Chinese skull was found to be in many respects similar to that of *Pithecanthropus erectus*, but somewhat larger and more developed. It has the same strong brow-ridge or *torus*, and may be considered as being intermediate between the Java and the Neanderthal man, though on the whole nearer to the former. Professor Elliot-Smith considers this skull to be in some respects intermediate between the Java skull and that from Piltdown, which will be found described lower down.

Thus we have a series of skulls, ranging from the Gorilla or Chimpanzee, through Java man and Peking man to Neanderthal man, and, perhaps, Rhodesian man, all characterised by the great brow-ridge or *torus*, and showing a steady growth in size and brain capacity. The greatest gaps are between the Gorilla and the Java man, and between Neanderthal man and modern man, *Homo sapiens*. It is true that in 1927 Dr. Hrdlička

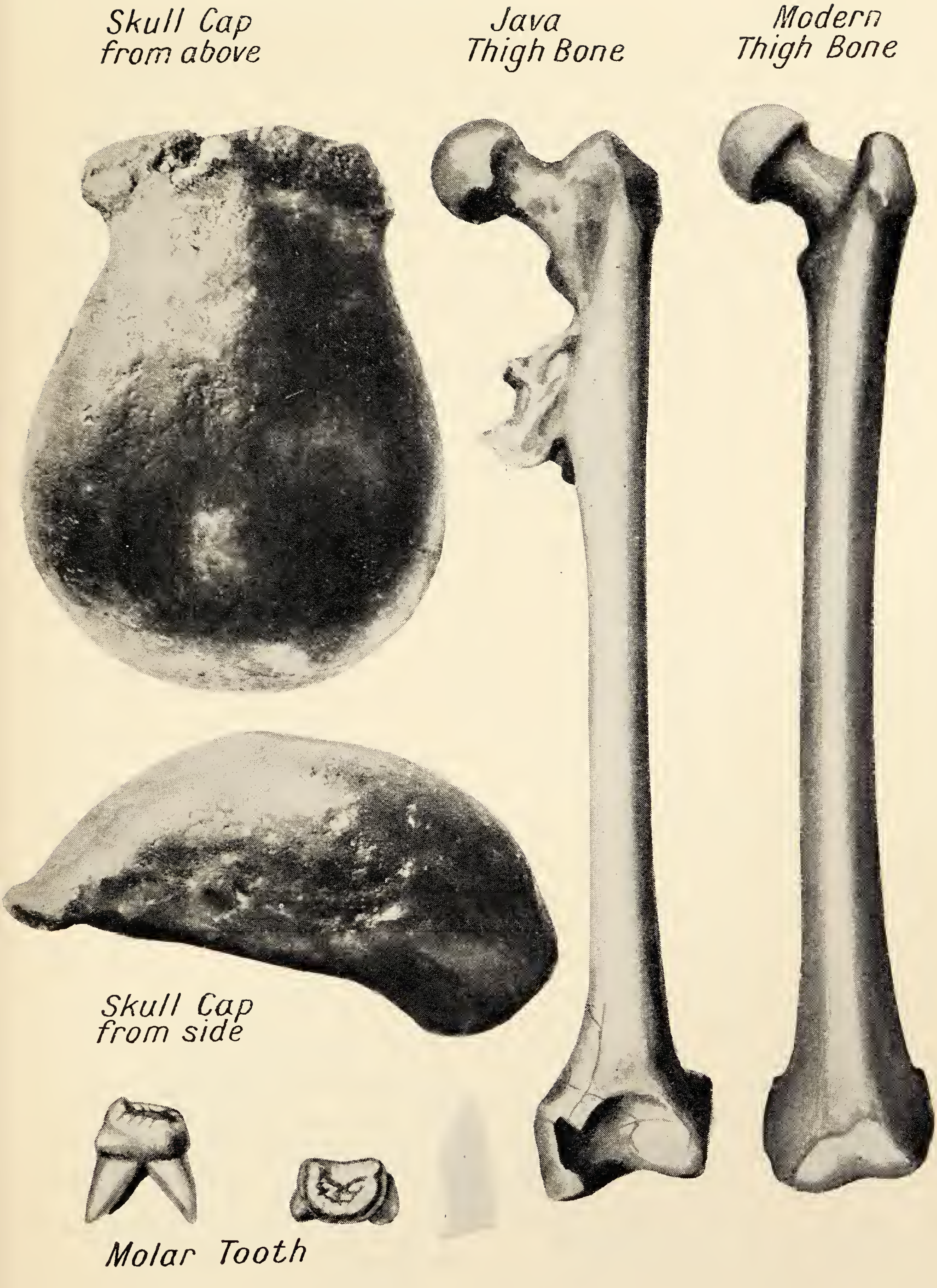

Plate V. Bones of Pithecanthropus from Trinil, Java

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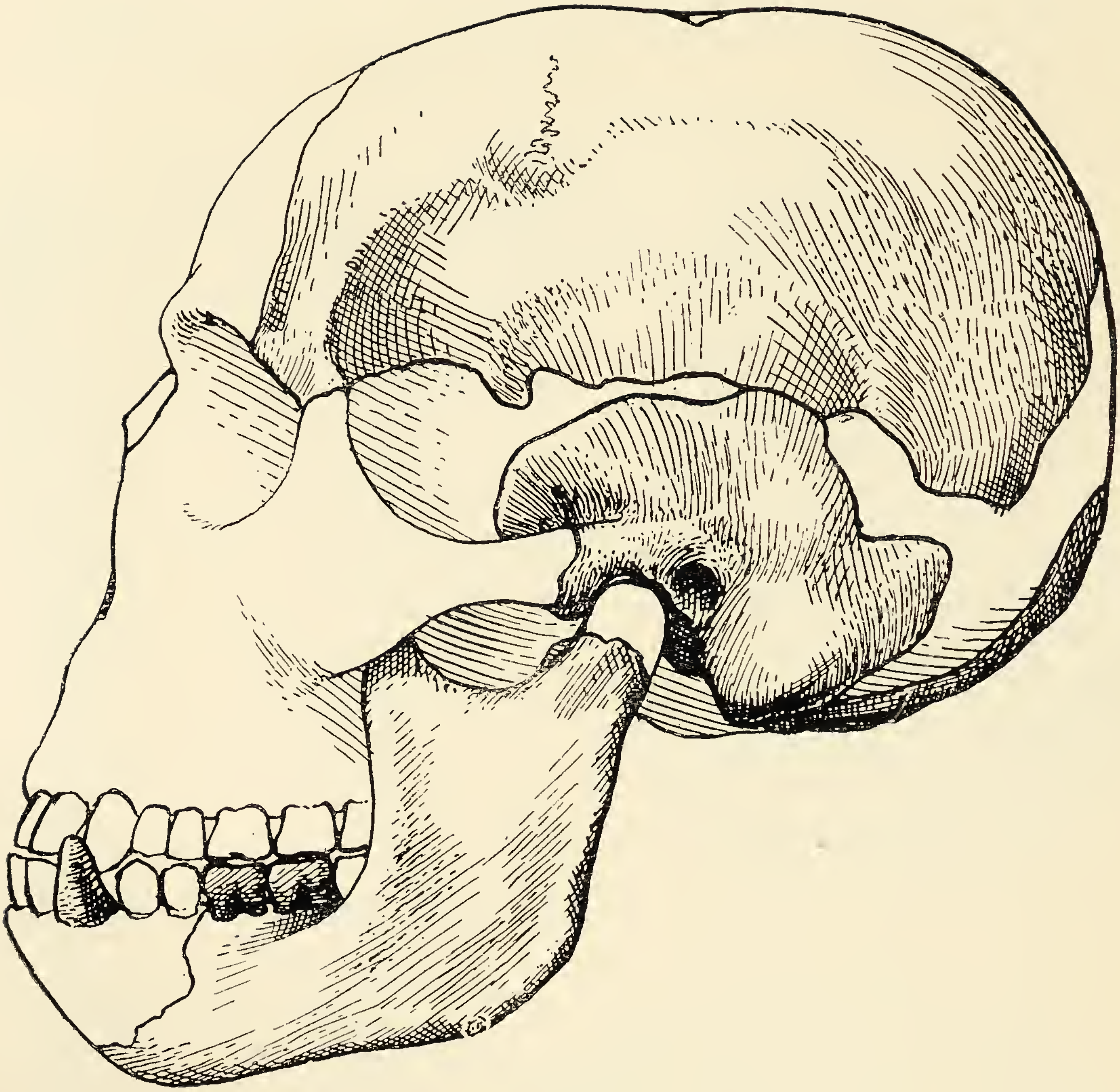
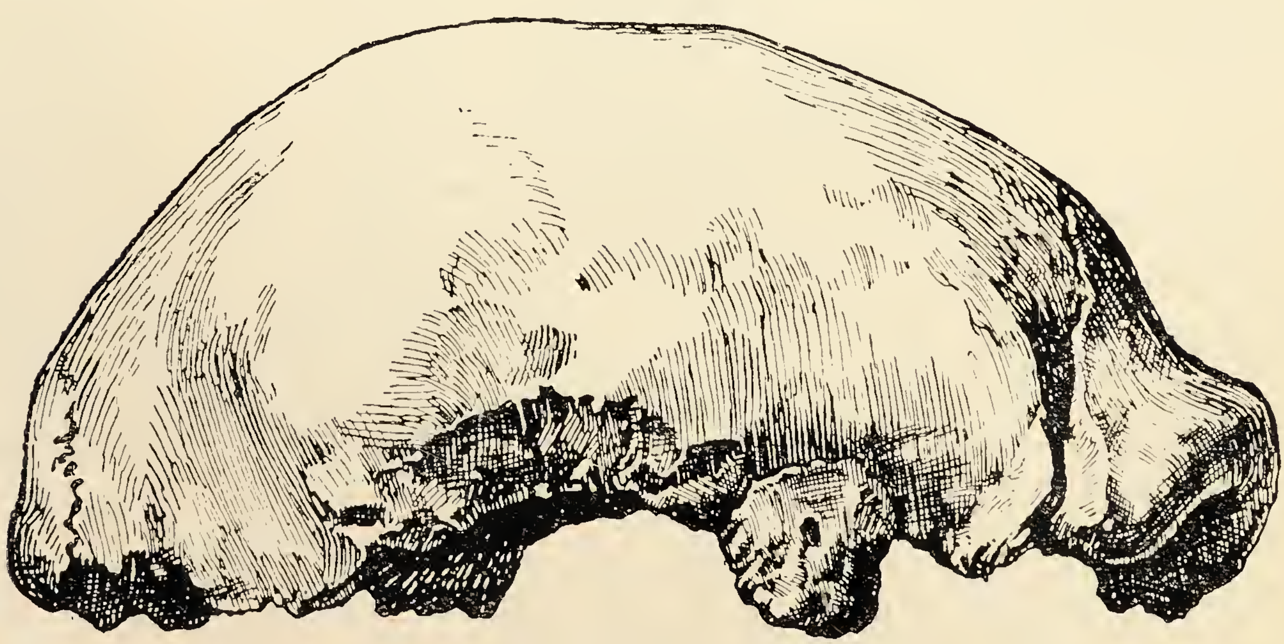


a. Skull of Piltdown man: profile



b. Neanderthal skull

PLATE VI. THE PILTDOWN AND NEANDERTHAL SKULLS

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maintained that modern man was descended from the Neanderthal species, but the majority of anthropologists consider that he is less a descendant than a member of a collateral line. Still from Java man to Neanderthal man the line of evolution is clear, and we may perhaps place in this series the jaw, found in a sand-pit at Mawer, near Heidelberg, in 1907, which lies intermediate in time between the Peking and the Neanderthal skulls.

There was, however, another type of early man, in which the strong brow-ridge, of ape-like appearance, was entirely absent. In 1908, and again in 1911, the late Mr. Charles Dawson, of Lewes, picked up from a bed of gravel close to Piltdown Common in Sussex, two fragments of a highly mineralised human skull. Sir Arthur Smith Woodward and he then searched this bed of gravel with unexampled thoroughness, and by the spring of 1912 they had discovered nearly the whole of a human skull of quite exceptional type. This clearly had belonged to a new species, and, as they thought, to a new genus of man, and Sir Arthur gave it the name of *Eoanthropus Dawsoni*.

This skull, which is of small size but of great thickness, has a perfectly smooth and well-developed forehead, entirely devoid of the great brow-ridge or *torus* that is invariably present in the other species that have been described. The forehead is, in fact, smoother than that of many individuals that we may meet with in this country and elsewhere. The jaw, however, was extraordinarily prognathous, far more so than in other species, and was so ape-like that for some time an American anthropologist claimed that, though the skull was human, the lower jaw had belonged to an extinct and otherwise unknown Chimpanzee.

The bed of gravel in which this skull was found lies eighty feet above the level of the Sussex Ouse, which

runs in the valley beneath. The gravels that lie at this height above the present rivers often contain flint implements slightly, but only slightly, earlier in date than implements of the type always found with the remains of Neanderthal man. It is believed, however, that this skull has been washed down from a higher and earlier gravel, but from what level is uncertain. We cannot be sure, therefore, of its relative date, but it is generally agreed that it is later than the remains of Peking man, still more so than the date of Java man, and it is thought that it is about contemporary with the Mawer jaw.

Quite recently Sir Arthur Keith has suggested that the fragmentary remains of a female skull, found at a great depth in the City of London, while digging the foundations of the new building for Lloyd's, belonged to a type related to and descended from the Piltdown man. It is true that, as far as can be judged from its fragmentary condition, the brow of the lady of Lloyd's was as smooth as her predecessor's, but most other anthropologists believe that the lady, who was living on the site of London in the time of Neanderthal man, was an early and primitive member of the species *Homo sapiens.*

Thus among the early remains of man we have two series. One with the heavy brow-ridge or *torus* that links the Gorilla to the Neanderthal man; the other, of which only one species is known, with a smooth forehead but a very ape-like jaw. Since no existing ape was known with a smooth forehead, this was a very puzzling feature in the Piltdown skull, but a partial explanation has been opened up by a recent discovery in South Africa.

In November, 1924, the skull of an extinct anthropoid ape was found in a pocket in the limestone at

Taungs, in Bechuanaland; it was soon afterwards described by Professor Raymond A. Dart, of the University of the Witswatersrand, and by him named *Australopithecus africanus.* This skull has a remarkably smooth forehead and in many respects resembles that from Piltdown, only the South African skull undoubtedly belonged to an ape, while the Sussex specimen is admitted by all to be human.

We seem to be faced here with a new problem. Is it possible that the Java, the Peking and the Neanderthal types were descended from the same group of apes as the Gorilla and the Chimpanzee, while the man of Piltdown had as an ancestor an African ape allied to the one that left his skull at Taungs? This seems to be a possibility, but we need to know much more before coming to a final conclusion.

During the geological period known as the Miocene a genus of fossil apes, *Dryopithecus*, about the size of a Chimpanzee and not wholly unlike it, ranged over the land lying between Western Europe and India, and continued to do so during the earlier part of the next period, known as the Pliocene. About the same time a similar ape, named by Dr. G. E. Pilgrim, its discoverer, *Sivapithecus indicus*, was living in the Siwalik Hills at the foot of the Himalaya Mountains. The latter, of which the jaw only is known, has teeth so closely resembling those of man that Dr. Pilgrim was at first inclined to include it in the human family. Unfortunately the remains of *Dryopithecus* and *Sivapithecus* are few in number, and in either case we have little but the jaws and teeth to help us, so we cannot tell what their foreheads were like, whether with strong brow-ridges like the Neanderthal man, or smooth like the skull from Piltdown. It is, however, possible that those with strong brow-ridges passed from being apes to

becoming men somewhere in Central Asia, where both *Dryopithecus* and *Sivapithecus* had roamed, while the men with smooth foreheads developed somewhere in Central Africa from an ape ancestor, not unlike and possibly related to the *Australopithecus* of Taungs. On the other hand, though *Dryopithecus* in many ways resembles the Chimpanzee, in others it is closely related to the Taungs ape, though very much earlier in date. It is thought by many that some species of this genus was either an ancestor of the human races, or, at any rate, closely allied to one. *Sivapithecus*, on the other hand, appears from its teeth more closely to resemble the human form and is somewhat later in date.

We see then, that during the Pleistocene period a great variety of human beings were living in different parts of the world, and, since we have very few specimens of each, for human skeletons are very fragile and liable to be broken into unrecognisable fragments, we may assume that many more genera and species existed besides those of which we have evidence. Nevertheless to-day there is only one species of man living on the earth, *Homo sapiens*, who has succeeded in surviving after all the others had perished, and this species has become much modified during the last twenty thousand years, so that it is possible now to distinguish a large number of varieties of races.

CHAPTER III

THE EXISTING RACES OF MAN

Modern men, though very varied in appearance, are all believed to be of the same species, *Homo sapiens*, but divided into a number of races or breeds. Though certain groups of these are strongly contrasted, so many intermediate forms are to be found that it is not an easy task to define their characters. For long it was believed that the various races had arisen long ago in areas isolated from other parts of the world, and that subsequently members of these specialised races had intermingled and interbred, thus giving rise to a number of intermediate types. That such cross-bred types have often arisen in the past as they do to-day is undeniable, but the opinion is gaining ground that few, if any, groups of men ever lived in complete isolation from their neighbours, that there were always people wandering, even if in small numbers, in the intervening regions, and that some, at least, of the intermediate forms have grown up, not as the result of interbreeding, but as an adaptation to their environment in the region lying between those in which the more highly specialised races arose.

As we have seen in our first chapter, earlier observers classified mankind by the colour of their skins, distinguishing apart white men, brown men, black men, yellow men and red men. This classification was far from being scientific, nevertheless the result does not differ greatly from the more recent conclusions of

anthropologists based upon the scientific study of the problem.

Of late years, especially since the beginning of the nineteenth century, a number of more scientific classifications of the races of man have been published; these differ slightly from one another, according to the relative degree of importance attached to the colour of the skin, the shape of the head and the form of the nose and hair. Nevertheless the differences observable between these schemes are not extensive nor important. One of the latest of these schemes, first published in 1909 and again with modifications in 1924, is by Dr. A. C. Haddon, and is based primarily upon the nature of the hair. This, like all such schemes, is formed on the model of the classifications used for plants and animals, and Dr. Haddon warns us that such a scheme can very rarely indicate biological affinities.

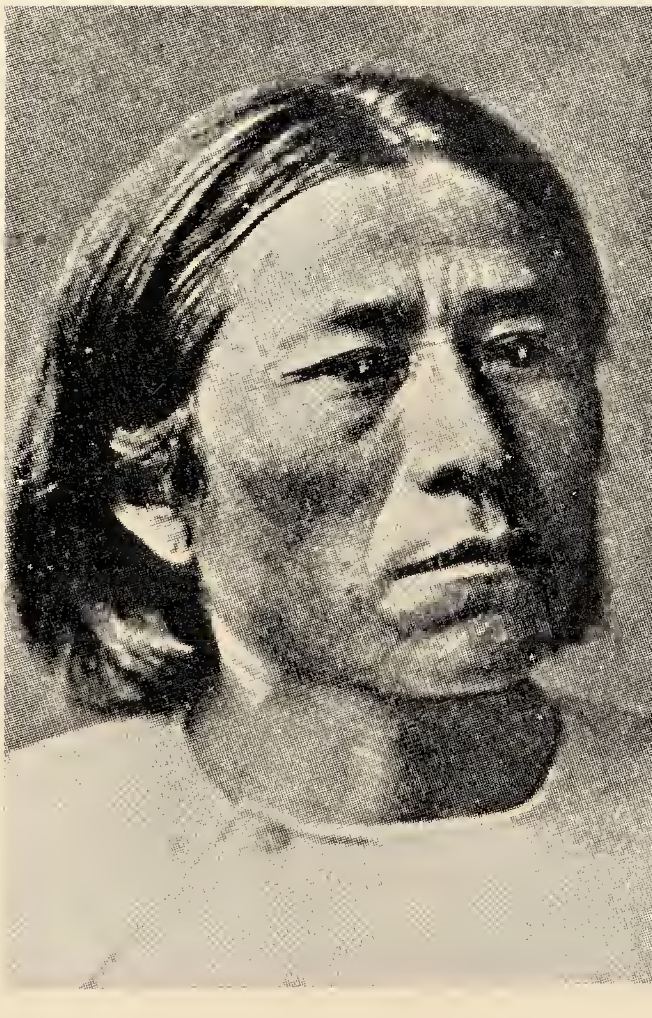
Dr. Haddon begins by dividing mankind into three great classes, according to the nature of the hair: those in which the hair is woolly, wavy or straight. Those with frizzy hair he includes in his second class.

The woolly-haired class is divided into two main groups, the Eastern and the African, and these are again sub-divided. The Eastern group is divided into a pigmy Nigrito race, including the Andamanese, the Semang of the Malay peninsula, the Aeta of the Philippines and the Tapiro of New Guinea. These are all very short, with heads of medium breadth and dark skin. The other, the Papuan or Melanesian race, are of moderate stature and sometimes tall, long-headed and have also dark skins. The African group is divided into three races. The first or Nigrillo race includes the Akka, the Batwa, the Ba Mbute and other kindred tribes; they are of very low stature, with heads of medium breadth and with yellowish skins. The second, the

a. Brown man

b. Black man

c. Yellow man



d. Red man

PLATE VII. FOUR TYPES OF PIGMENTATION

[*Face page* 18

Plate VIII. African Pigmy

Face page 19]

Bushman race, includes that people and the Hottentots; they are very similar, but not quite so short. The last race, the Negro, comprises the bulk of the population of Africa south of the Sahara Desert, the Negro of the Congo basin, the tribes dwelling on the Upper Nile and all the Bantus.

The wavy-haired class, which includes those with frizzy hair, comprises three groups, those with long heads, those with heads of medium breadth and those with very broad heads; the first two of these groups have been further subdivided. Among the long-headed members of this class Dr. Haddon recognises three groups. Of these the first is dark-skinned and the stature medium or short. This group he has again sub-divided into two, in the first of which the nose is broad; this race includes many of the primitive tribes of India, the Bhils, the Gonds, the Oraons and the Kolarians, the Veddahs of Ceylon, the Sakai of the Malay Peninsula and the Aborigines of Australia. The other sub-group, with the same characters except that the nose is rather narrower, includes the Dravidian-speaking peoples of India and some of the inhabitants of the Nile Valley and Somaliland. The second group, the members of which are somewhat lighter in colour, and of variable stature, include the Indo-Afghan tribes, the Indonesians of the East Indies and the native tribes of Eastern America. The third group, which has a tawny white complexion, black hair and medium stature, includes the main bulk of the population living on both sides of the Mediterranean Sea and in Arabia.

The second group, with heads of medium breadth, he has divided into three: the peoples of Western Europe, with tawny white complexion, black hair and medium stature, the peoples of Northern Europe, with fair hair, light eyes and great stature, and the Ainu in the northern

island of Japan, with light brown skin, profuse black hair and medium stature.

The last group, with broad heads, sallow or tawny skin, sometimes tall and sometimes of medium stature, includes the peoples of the Alpine region of Europe, of the Balkan Peninsula, Anatolia and to some extent of Turkistan, and various individuals found scattered among other types in Europe and the western half of Asia.

Lastly we come to the straight-haired races, of which Dr. Haddon distinguishes three. The Eskimo, with long heads, brownish or reddish-yellow skins and medium stature; the peoples of North Asia and North-west America, with heads of medium breadth, yellowish brown skins and variable stature; and lastly the Mongol race, with broad heads, skins varying from yellowish-white to copper-brown, also with very variable stature.

A scheme of classification, such as that drawn up by Dr. Haddon, has the merit of simplicity and can readily be mastered and committed to memory. It has, also, obvious and admitted defects. Though under such a scheme all groups of mankind, having similar physical characters, can be grouped together, there is a serious doubt how far this signifies a common origin or a near relationship. The evidence deduced from the study of ancient skeletons, and the restoration of ancient history from archæological material, suggest a close relationship between several peoples that are separated from one another in this and other schemes. We must, therefore, proceed with caution if we are to utilise this scheme as a means for deducing the past history and movements of mankind, and the same is equally true for the many other similar schemes that have been advanced by anthropologists in recent years.

There is, however, another way of approaching the problem. Let us imagine that modern man, *Homo*

sapiens, first arose south of the great mountain zone that runs, almost without a break, from the Pyrenees to the Himalayas and continues thence to the end of the Malay Peninsula, at the time that Neanderthal man was wandering north of the mountains from Northern China to Europe. This, at any rate, seems to be a plausible hypothesis. Let us imagine, too, that the earliest variety of modern man had a brown skin, dark hair and eyes, and a head of medium breadth; it is reasonable to suppose that his stature would vary according to the amount of muscular energy that he exerted and to the abundance of game that he was able to capture. Let us imagine, too, that besides this variation his skin became darker towards the south-east, until it was nearly black in what are now the East Indian Islands, which were then connected with the mainland mass, and that as the skin varied from light brown to nearly black, the hair at the same time passed from wavy to frizzy.

Such a proposition does no violence to anything that we know of the population of this territory in ancient or modern times, and it forms a good basis upon which to build a working hypothesis as to the movements and evolution of the races as known to us to-day. It seems reasonable to believe that this brown race, shading to black, covered the whole region between the Atlantic Ocean, across the Sahara Desert, most of which was then a grassy steppe, as far as the easternmost of the East Indian Islands, while the last great Ice Age covered both North and Central Europe as well as Central Asia with its icy mantle.

As modern man increased in numbers it became necessary to enlarge his territories, for in a hunting condition each group needs a large area in which to maintain itself. Debarred by the ice and snow from northward expansion and by the thick forest belt of the Congo

basin from advance into the tropical regions of West Africa, it was only possible to extend down the eastern grasslands of that continent, and, by taking to the sea in primitive rafts, to invade Australia, Tasmania and New Guinea. Both of these movements seem to have been early and may well have taken place while the last Ice Age was at its maximum.

As the snow and ice began to retreat some, as our archæological evidence proves, entered Europe, probably across a land bridge between Sicily and Tunis, and possibly, also, across the Straits of Gibraltar, which, if they existed at all, were much narrower than at present. It seems likely, also, that others drifted through a pass in the Kopet Dagh range, to the north of Persia, and, skirting the Hindu Kush mountains and other ranges in Central Asia, spread over the tundra regions of Siberia. Some of these took to a life of fishing in Arctic waters and became the Eskimo, while others hunted on the tundra in the summer and took refuge in the foothills to the south during the winter. After the Ice Age had completely passed away, some of these, in many successive waves, peopled the two continents of America.

About the same time, as the glaciers and snow-fields of the mountains retreated up the valleys, other modern men settled on the slopes of the hills, moving up higher and higher as the Ice Age passed away. This may have happened at many places, but the two most important centres seem to have been Armenia and the plateau of Mongolia. In these two regions, for some reason not at present understood, the inhabitants became broader and shorter in the head; in Armenia the heads tended to become high, while in Mongolia they remained low and the people developed that peculiar folding of the eyelid known as the Mongol eye. Those in Armenia spread eastward to the confines of Tibet and form an

element in the present population of that country, and westward into Europe, where we can trace them as far as the coast of Portugal. Those remaining in Armenia and Anatolia became taller, and their heads increased in height, with very flat backs. This broad-headed race is often called the Alpine race, since it is found more commonly in mountain regions.

There were numerous other moves from the original home of modern man, all of which cannot be traced in detail. It would appear that the Ice Age was nearly past when the ancestors of the Bushmen and Hottentots migrated to South Africa, where they have probably diminished in size owing to the scarcity of game in the desert regions to which they were driven at a later date by the Negro.

The origin of the Negro race is more obscure. It is possible that they represent an early move towards the tropical forest from the grasslands of the Sahara, and that the Eastern Black Folk, who so closely resemble them, were a parallel development in the tropical regions of the Pacific. It is also just possible that the development of the black skin and the woolly hair took place in New Guinea and Melanesia out of the dark-skinned and frizzy-haired people that at first occupied all the region between South India and the East Indies. If that were so, then the African negro must have migrated westward, keeping as near as possible to the tropics, at a time that cannot have been much later than the final disappearance of the Ice Age and may have been earlier.

This chapter must not close without a word on the peoples of Europe. The brown men, who we have seen were in early occupation of North Africa, seem there to have developed longer and narrower heads and a relatively slight build. Some of these entered

Europe as the ice was retreating, but there seems to have been a much greater invasion of these folk into southern and western Europe as the climatic conditions improved. These are generally known as the Mediterranean race. We have already seen how the Alpines spread along the mountain zone from Armenia to the Pyrenees. They came in many waves, but two chief movements have been noted. One very early brought to Central and Western Europe a type relatively short and of stocky build, with heads that are not very high; these are usually known as the Western Alpines. Later came another wave, tall with very high heads, which filled Anatolia and the Balkan Peninsula, and even reached parts of Tyrol. These are known usually as Eastern Alpines or Armenoids. This type also penetrated Syria as far as Judaea.

At a fairly early date some of the North African people seem to have passed through Persia and through the gap in the Kopet Dagh range already mentioned, and to have thus reached the grassy steppes of Turkistan and South Russia. These have rather broader heads than those in the Mediterranean region and became taller and fairer, with grey or blue eyes, and brown or sometimes flaxen hair. These, now called the Nordic race, overran large parts of Europe soon after 3000 B.C., and many of them settled by the Baltic Sea, where they became still taller and of still fairer complexion, and from thence they again overran large parts of Europe on the downfall of the Roman Empire.

Lastly in North-east Europe, from Lapland and Finland to the borders of Siberia, there are people who do not belong to any of these three principal races of Europe. These seem to be an extension of the brown people, who reached Siberia in early times, perhaps with a slight infusion of Mongol blood from the Mon-

golian plateau. They seem to have reached North-east Europe from Asia in many waves, the earliest, represented by the Lapps, having arrived soon after the disappearance of the ice sheet.

From this brief survey of the existing races of mankind we see that all of them belong to the same species, *Homo sapiens*, for all of them interbreed freely, while none of them resemble any of those ancient types which long ago became extinct. Yet, though all are members of one species, they exhibit an infinite variety. They are of all colours, white, yellow, red, brown and black, and of every intermediate shade. Some, like the Scots, the Swedes, and the Patagonians, are, as a rule, very tall, while others, like the Bushmen, the Akka, the Andamanese and the Semang, are so short as to be veritable pigmies. The hair, as we have seen, may be straight and coarse as among the Mongols, and vary in every degree of waviness until we come to the tightly curled pepper-corn covering of the African negro. Similar variations have been noted in the shapes of heads, noses and other features.

In spite of every attempt to do so, it has been found impossible to classify these races on any scheme that will show their true relationship. In each region the inhabitants have developed in a style that was found suitable to their environment, and, when a people have been long in one region, the characters so formed in response to local stimuli continue to develop, sometimes to an exaggerated extent. But men have always wandered and the whole world has been free to them. When a people, which has specialised in some direction in a given environment, has moved or been driven to another, the original direction of their development has changed, and evolution has begun in a different direction. Besides this, such wandering people have seldom entered

a completely uninhabited district, and it has not taken long, therefore, for the newcomers to mix among and intermarry with the older inhabitants, thus mingling the traits and the tendencies to further development. In this way progress towards extreme specialisation has been checked, and a host of intermediate varieties has sprung up.

As with the bodily form so it is with the fundamental mental characters of the different people. In each region, in response to local conditions, the inhabitants have been compelled to follow certain occupations along definite lines, and certain mental and psychic characters have in each case had special survival value. In a changed environment these may become of less importance, still they have been bred in the bone and tend to survive as virtues, even though they may bring in little or no advantage. There is some reason for thinking that certain virtues, and certain vices as well, are more commonly associated with certain physical types. If this is so, it is probably because those virtues had a special survival value in the environment in which that type first arose, while the vices may indicate that in their original home there had been no opportunity for their indulgence.

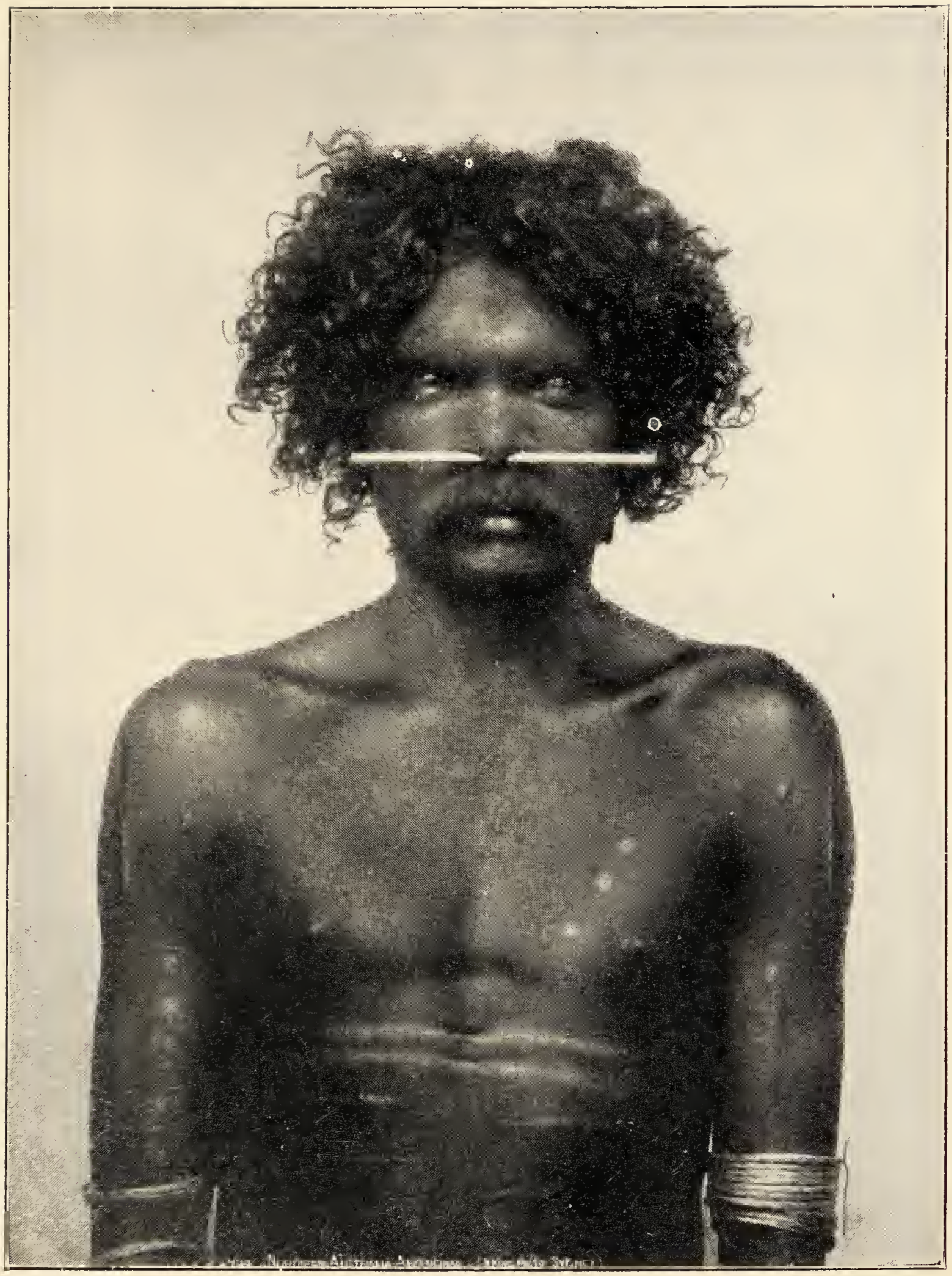
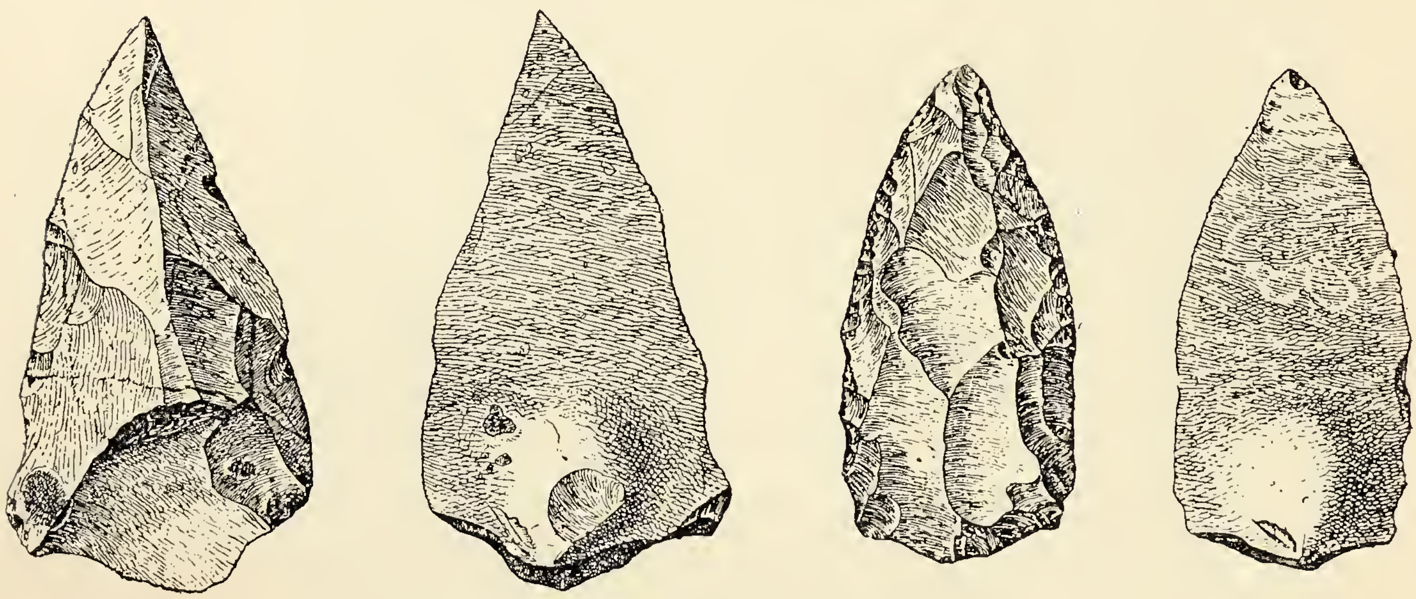


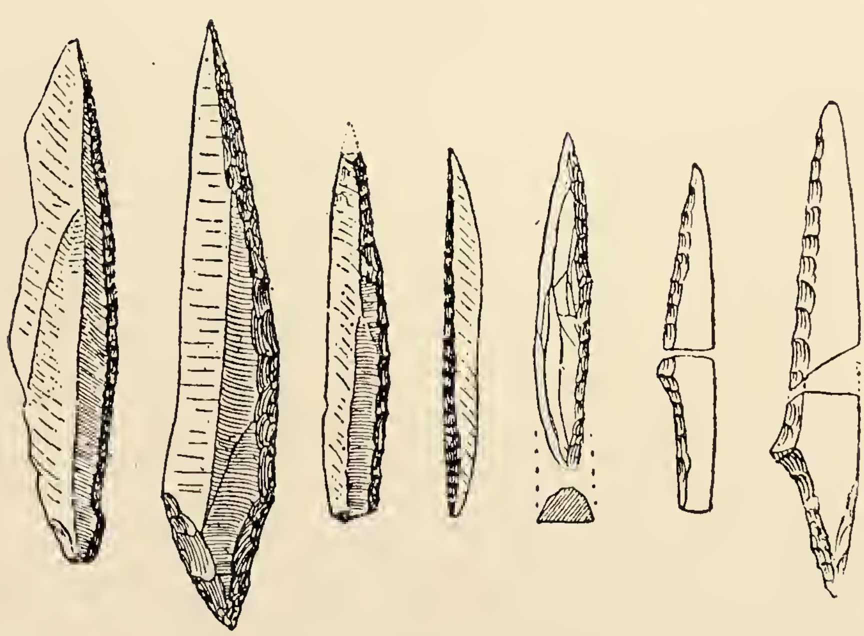
Plate IX. Australian

[*Face page* 26

a. Lower Palæolithic implements



b. Middle Palæolithic implements



c. Upper Palæolithic implements

PLATE X. PALÆOLITHIC IMPLEMENTS

CHAPTER IV

THE MEASUREMENT OF TIME

In the preceding chapters more than one reference has been made to geological periods, and in those that are to follow constant mention will be made of some of these periods and of those into which the early history of man has been divided. It is, therefore, not out of place to devote a chapter to describing these divisions of time and to indicate their meaning.

Most of the rocks that we find beneath the top soil of the earth, and which form its crust, have been laid down in successive ages, usually at the bottom of the sea or in the beds of lakes and rivers, though occasionally by the action of wind-blown sand or dust upon an already existing land surface. These rocks usually contain remains of plants and animals, from which we can discover the type of life existing here when these deposits were laid down.

Geologists have in most cases determined the succession of these various beds, and have grouped them into several large and many more smaller series, ascertaining which deposits in one country were laid down at the same time as rocks in another by means of a study of the remains of life contained in both. Some of the earlier rocks, most of which are found exposed in Canada, contain no vestiges of life, but the later rocks, in which remains of living things have been found, have been divided into three great groups: the Primary or Palæozoic, the Secondary or Mesozoic and the Tertiary or

Cainozoic. Earlier geologists recognised a fourth or later stage, which they called Quaternary, but, though this term is still sometimes used, this period is now generally included in the Tertiary, which, it is believed, has not yet come to an end. Of these three great epochs, the Primary is of much greater duration than the others, and it is the Tertiary only with which we are concerned.

The Tertiary or Cainozoic epoch is essentially the age of mammals, for this class of animal was but slightly represented in the preceding Secondary epoch, and then only by very small and primitive species, for the giant reptiles then dominated the world. This Tertiary epoch is usually divided into six main periods, the Eocene, or dawn of recent life, the Oligocene, with little recent life, the Miocene, with more, the Pliocene, with much, the Pleistocene, with very much, and the Holocene, in which we are living, which is completely recent. The Pleistocene and the Holocene, which contain all, or nearly all, the evidence relating to man, were formerly known as the Quaternary epoch. In this volume we are not concerned with anything earlier than the Miocene period, in which, as we have seen, *Dryopithecus* wandered between Western Europe and India.

The Pleistocene period witnessed great changes of climate in almost all parts of the world, for this was the period of the Great Ice Age. The theory that at a time not very remote the Swiss glaciers had extended far below their present level was hinted at by Goethe early in the nineteenth century, and was expounded and widely published by Agaziz a few years later. Soon afterwards it was pointed out that about the same time Scandinavia had been covered by a great ice sheet. At first it was believed that this was a single event, but after a time it was discovered that in a bed of clay lying

between the deposits laid down by glaciers at Hötting, a suburb of Innsbruck in Tyrol, there were impressions of the leaves of the rhododendron, which will not now live through the winter on that site. It seemed clear from this evidence, though many geologists would not admit it, that there had been at least two Ice Ages, and that between them the climate had been much milder than at present.

About the beginning of the present century two continental geologists, Penck and Brückner, published a careful survey that they had made of the deposits laid down by the glaciers in the Alpine region, stretching from Styria to the Lower Rhône. From these studies they concluded that there had been four great Ice Ages, which they called the Günz, the Mindel, the Riss and the Würm, between which there were interglacial phases in which warmer conditions had prevailed. They further declared that the evidence showed that the Würm glaciation had had two maxima, separated by a slight alleviation of the arctic conditions, which they termed the Laufen retreat. Lastly they pointed out that the recession of the glaciers after the second maximum of the Würm had for a time been of an intermittent character, which they called the Achen oscillation, and that this was followed at intervals by three advances or arrests of the glaciers, which they named the Bühl, the Gschnitz and the Daun stadia. It is easy to remember the order of these events, since the initials of the first series, G, M, R and W, come in the order that that appear in the alphabet, while the remainder follow the Greek alphabet, α, β, γ and δ.

For a long time this scheme was scouted by those who still believed that there was only one Ice Age, and who are called uniglacialists. In time, however, the majority of geologists came to accept this theory,

with or without modifications, and to-day all but a few accept the multiglacial view. The Günz glaciation was placed by Penck and Brückner at the close of the Pliocene period, but this is not of much consequence, since the boundary line between that period and the Pleistocene is not too well established. Some authorities have failed to find adequate evidence for the Günz glaciation in Western Europe, which suggests that its centre lay somewhat to the east. Others would reduce the glaciations to a smaller number, believing that some of the interglacial phases were so slight that two glaciations might well be merged in one, as had been suggested for the two maxima of the Würm by Penck and Brückner, who in recent years have discovered that the Bühl stadium was a triple, and not a single, event. In spite of these divergent views on detail, it is convenient to use the full scheme of Penck and Brückner for measuring periods of time during the Pleistocene period.

Many causes have been advanced to account for the Ice Age and its various phases, some geological, some climatic and some astronomical. The present writer still adheres to the view that he advanced some years ago, according to which the Ice Ages were caused by the elevation of the land masses, thereby vastly increasing the snow-fields in the mountain regions. The duration of the Pleistocene period is also a matter of dispute. The present writer has suggested that the time that has elapsed since the beginning of this period to the present day need not, on the evidence available, have been more than 250,000 years. Recently Professor Elliot-Smith has argued from other evidence that this time must be reckoned as 1,000,000 years. While his argument may convince some, it is not likely that he will convert all, unless his evidence is considerably strengthened, and we must leave this for the moment as an open

question, and believe that the duration of the Pleistocene and Holocene periods combined lies somewhere between a million and a quarter of a million years.

Early in the nineteenth century the Danish archæologists began to collect the prehistoric remains found in their country into their National museum, and to arrange these according to the material used, stone, bronze and iron. This led them to argue that there had been three periods, in the first of which tools and weapons had been made of wood, stone, bone and horn, but metal was unknown, then a period in which the best implements had been made of bronze since iron was unknown, and lastly a period in which all cutting implements had been made of iron or steel. Thus they considered that mankind had passed through three ages, the Stone Age, the Bronze Age and the Iron Age. In coming to this conclusion they had arrived at a result already hinted at by Hesiod in the eighth century B.C., and more explicitly stated by Lucretius in his poem on "The nature of things" before 50 B.C.

This idea of dividing man's past history into the three ages of Stone, Bronze and Iron was introduced soon afterwards into this country by Sir John Lubbock, afterwards the first Lord Avebury. It was soon found, however, that while great numbers of stone implements were found on or near the surface, and that many of these had been ground or polished all over, others, and these always roughly flaked, were found in the gravels of old river beds, associated with the bones of extinct animals. Lubbock, therefore, suggested that the implements from the gravels should be relegated to a Palæolithic or Old Stone Age, while the polished and other surface implements should be considered as dating from the Neolithic or New Stone Age.

Later on it was found that flaked stone implements were to be found, not only in the gravel terraces in the river valleys, but in the deposits beneath the floors of caves. Thus the Palæolithic Age was for a time divided into two periods, the drift period and the cave period. Further investigation showed that while some types of implements were found only in the gravels and others only in the caves, one type was found on both kinds of sites. Further classification was made, based on the forms of the implements, until the following scheme was adopted.

It was decided to divide the Palæolithic Age into three periods, the Lower, Middle and Upper, and to recognise in the Lower Palæolithic period two industries, named from the sites at which they were first found, Chelles and St. Acheul. Some archæologists would add to them a third still earlier industry, which they call pre-Chelles. To the Middle Palæolithic period they relegated the industry, sometimes found in the gravels and sometimes in the lowest layer of the caves; this they termed Le Moustier, and this is the industry that is found with Neanderthal man. Lastly there were three industries, almost always found in caves, though more recently some implements of this type have come to light in the open and in the lowest gravels of our river valleys; these they termed the industries of Aurignac, Solutré and La Madeleine. The last is but a more developed form of the first, while that of Solutré seems to have been brought in by invaders from the east, who drove many of the Aurignac cave-dwellers from Central France into Spain.

These three great and seven minor divisions of the Palæolithic Age still in the main hold good, though various other industries are believed by some to have been contemporary with them. Thus the Levallois

Plate XI. Mesolithic Implements

[*Face page* 32

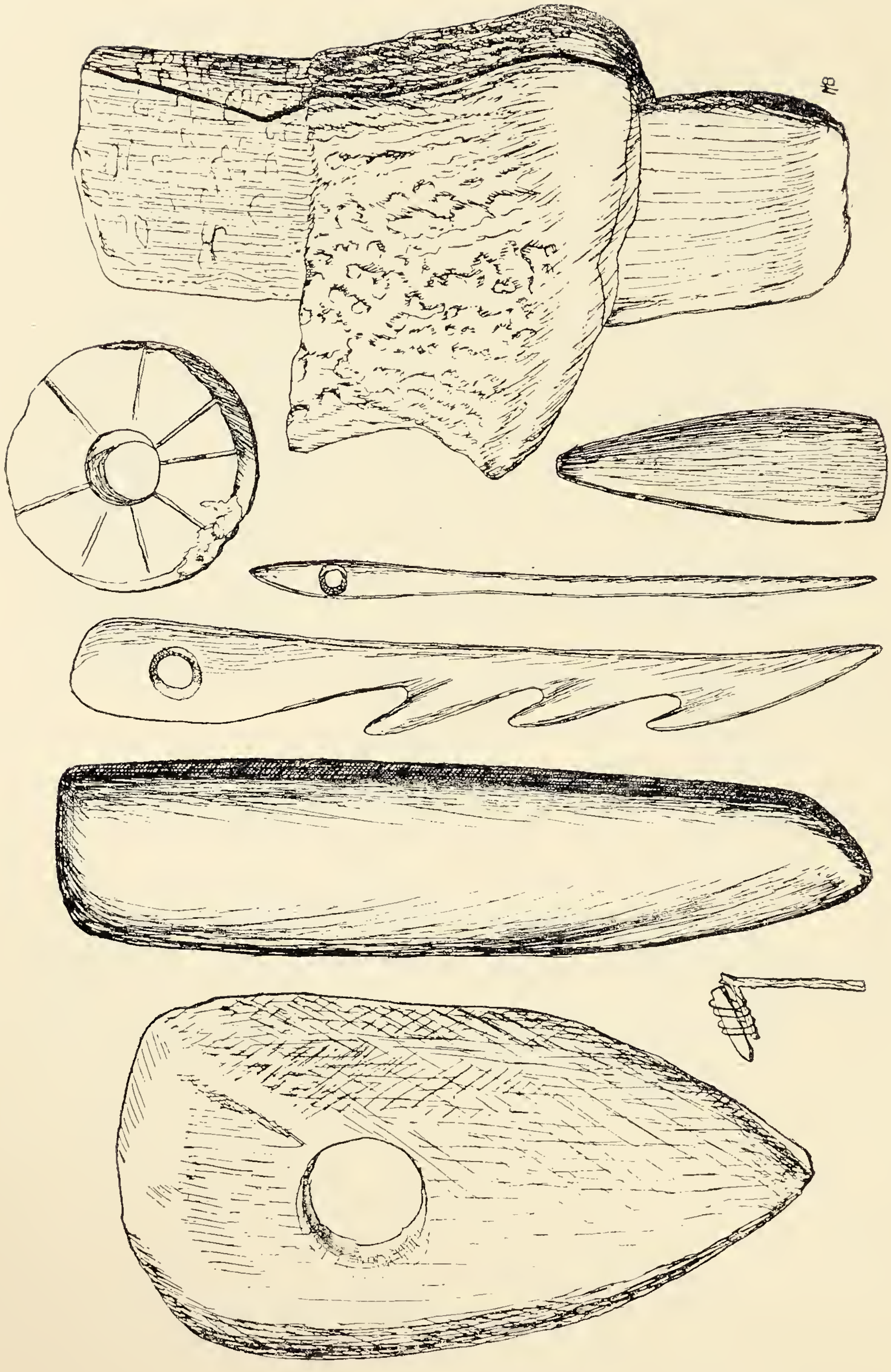


Plate XII. Neolithic Implements

Face page 33]

industry seems to be an earlier phase of that of Le Moustier during the time of the St. Acheul industry, while the Solutré phase was not much felt in Britain, where the industry of Aurignac continued with little change during the time that the industry of La Madeleine flourished in South-west France.

Still earlier industries are recognised by some archæologists, though they have not yet gained the adherence of all. Among these are the eoliths, first recognised by the late Benjamin Harrison, the Rostro-carinates from beneath the Red Crag and the Foxhall flints, from the middle of that deposit. These may be considered collectively as belonging to the Eolithic Age.

Lastly some implements, at first believed to be Palæolithic, together with some that were at first thought to be Neolithic, have in recent years been relegated to a new phase, known as the Epipalæolithic or Mesolithic Age.

While the Palæolithic Ages, including the Eolithic Age, belong to the Pleistocene period and date from the time of the Ice Ages, though the Upper Palæolithic industries are thought to date from its closing phase, the Achen oscillation and the Bühl stadium, the Epipalæolithic or Mesolithic Age is believed to date from the time when the Ice Age with its arctic conditions had completely passed away and the climate was as warm, and perhaps warmer, than at the present day.

It was at first believed that the industry of the Neolithic Age was directly derived from that of the Palæolithic, or at least of the Mesolithic Age, and that it was of many thousands of years' duration. The idea is now gaining ground that this industry in Northern and Western Europe is derived ultimately from the South-east, and has arisen from a culture in which copper was well known, though the knowledge of this metal was lost

as the other elements of this civilization travelled to the north and west. It is now believed by most archæologists that its duration in this part of Europe was not more than a very few centuries.

In the Near East copper had been known for a long time before the knowledge was acquired that the addition to it of about 10 per cent. of tin would make an alloy much harder than either of the component metals. Thus a long Copper Age preceded the true Bronze Age, which in the European region cannot be considered to have started much before 2000 B.C., although objects composed of a 10 per cent. bronze have been found in Mesopotamia dating from a much earlier time. Still the Copper and Bronze Ages combined are often spoken of together as the Bronze Age.

In the Near East, at any rate in Egypt and Mesopotamia, we have no clear evidence of a true Neolithic Age, for small quantities of copper have been found in all but the very earliest deposits. In these lands writing goes back to a very early date, so that we have to some extent a written history from fairly early in the Copper Age. The dates of events in Mesopotamia are much disputed prior to about 3100 B.C., but since that time the succession of several lines of kings is known with the approximate dates of the reign of each, so that most events can be dated with only a small margin of error.

The best attested series of dates comes from Egypt. Here the ancient historians considered that thirty dynasties had ruled from the time that Menes united the kingdom into one until Alexander the Great conquered the country in 332 B.C. The date of Menes has long been in dispute, but nearly all Egyptologists are now agreed that he unified the kingdom about 3400 B.C. with a margin of error on either side of not

more than 200 years. Dynastic times have been divided into several shorter periods, the Proto-dynastic period, Dynasties I and II, from 3400–3000 B.C. the Old Kingdom, Dynasties IV to VI, 3000–2475 B.C.; the first intermediate period, during which the kingdom was in a turmoil owing to rebellions and invasions, Dynasties VII to X, 2475–2160 B.C.; the Middle Kingdom, Dynasties XI and XII, 2160–1788 B.C.; the second intermediate period, when the kingdom was overrun by the Shepherd Kings, 1788–1580 B.C.; and the Empire or New Kingdom, Dynasties XVIII and XIX, 1580–1205 B.C. After that, while Egypt was declining, clear-cut periods are not so obvious.

But much is known of the civilization of Egypt before the rise of Menes; these are called Predynastic times, and are divided into three periods, the Early Predynastic or Amratian period, the Middle Predynastic or Gerzean period and the Late Predynastic or Semainian period. The dates of these periods are not yet well established, but more than one calculation places the beginning of the first of these about 4900 or a little after 5000 B.C. Before this we have two short phases, only recently discovered, the Badarian and before that the Tasian.

There is one other centre at which we have a good system of dating; this is in Crete. Though no written documents have been discovered here that can help us to elucidate its history, for the few that have been found are in an unknown script in an unknown language, so many objects of Egyptian origin have been found there, that each period can be dated with very fair precision. When Sir Arthur Evans first explored the remains of the palace at Knossos in that island, he found signs of a succession of phases of a Bronze Age civilization, which he called Minoan, after Minos the legendary

king of Crete. In this civilization he found three well-marked periods, during which civilization reached its high-water mark, and these he called Early, Middle and Late Minoan. In each of these periods he distinguished, too, three phases, one of improvement, one of perfection and the last of decline; these he has numbered I, II and III. Thus we have nine phases, which from their Egyptian associations can be dated as follows:

Early Minoan I, 3400–2800 B.C.
Early Minoan II, 2800–2400 B.C.
Early Minoan III, 2400–2100 B.C.
Middle Minoan I, 2100–1900 B.C.
Middle Minoan II, 1900–1700 B.C.
Middle Minoan III, 1700–1600 B.C.
Late Minoan I, 1600–1500 B.C.
Late Minoan II, 1500–1400 B.C.
Late Minoan III, 1400–1200 B.C.

Though all this civilization is considered to have belonged to the Bronze Age, for metal was common yet the use of iron was unknown, it must nevertheless be realised that it was not until the Third Early Minoan period that bronze makes its appearance and that up till then only copper tools were used.

Beneath the palace of Knossos Sir Arthur found a deep bed of rubbish, containing quantities of fragments of pottery; these he considered as Neolithic, though subsequent excavations have shown that a few copper tools were used during the last phase of this period, which ended about 3400 B.C., and began a great many centuries earlier.

This system of dating remains in Crete by means of imported objects from Egypt has enabled archæologists to date with fair precision the different civilizations that

flourished about the same time in other islands in the Ægean Sea and on the mainland of Greece and Asia Minor. Some products from these lands were carried up the Danube into Central Europe and by sea to Sicily and Spain, thus giving us a basis for dating the successive phases of civilization in those areas, and in like manner it is possible to give approximate dates for the remains in North and West Europe from the Neolithic Age to the time when written documents take up the tale.

CHAPTER V

EARLY TOOLS

MAN is essentially a maker of tools. This is one of the chief features that distinguishes him from the ape. The ape will use a stick or a stone as a tool when he finds it ready to hand, but has never been known to make one. When he first fashioned a tool we may consider that he thereby became a man. Up to that time all animals had been dependent upon their teeth and claws, and sometimes upon their tails, as in the case of the beaver, if they desired to construct a home or kill a fellow beast for food. Man, having invented a tool, soon invented others, and so provided himself with a variety of implements that could be used for various purposes. By this means he soon left the ape and other animals far behind in the race for success.

It seems probable that the first tools were made of wood and bone, but from the nature of the material the earliest of these have not survived. Wood is a very perishable material and we should not expect tools of this kind to have survived from a remote past. Nevertheless one has been found that dates from the Old Stone Age. It was found by Mr. Hazzledine Warren at Clacton-on-Sea, in Essex, in a deposit that contains remains of an early elephant, *Elephas antiquus*, and is believed by the finder to belong to an early phase of the Le Moustier period. Wood must, however, have been used at a much earlier period, and it has been conjectured that the eoliths, made known to the world

by the late Benjamin Harrison, and around which so much controversy rages, were chipped into the form in which they are found to enable their owners to whittle and smooth down long sticks or poles for use as spears.

Bone is not so perishable as wood, and tools of this material have been found on the sites of many early settlements. They are common among the remains of the cave period, and first make their appearance in any number in the cave deposits of Le Moustier date. One specimen, however, dates from a much earlier time. This is a curious implement, of unknown use, made out of the thigh bone of an extinct elephant. This implement, which had become highly mineralised from lying for a long time in a bed of gravel, was found by the late Mr. Dawson, on Piltdown Common, in the gravel bed in which he found the remains of the famous skull, described in a former chapter. If this bone implement had been dropped into the river that laid down this gravel then it must date, at the latest, from the St. Acheul period. If, however, like the skull it had been derived from another gravel at a higher level, then it must go back into quite early Pleistocene times. In any case it is the earliest bone implement yet discovered.

Both wood and bone have serious limitations as materials for the construction of tools, for neither is susceptible of acquiring a really sharp cutting edge, and as man advanced he needed something wherewith to cut his meat and skins, and with which to fashion more elaborately his tools of wood and bone. This cutting edge could be supplied by fractured pieces of various kinds of crystalline rocks, and by none so readily and so effectively as by flint.

Flint is found as nodules in many of the rocks, mostly in beds of the Mesozoic or Secondary formations, and, since such nodules are not readily destroyed, pebbles

of this material, large and small, are frequently found in gravel deposits of a later date, and occur in some places, such as Egypt, lying strewn upon the surface of the ground. It is readily fractured, leaving a keen sharp edge, and such broken fragments occur not uncommonly, due to natural causes. Though flint is not found everywhere, yet it is to be met with in many regions in all parts of the world. It seems likely that it was in one such region that a man discovered the value of this fractured flint, then made experiments to produce further fractures by hitting one stone with another, and so acquired the first cutting tool, which enabled him to enlarge and improve his stock of wooden and bone implements.

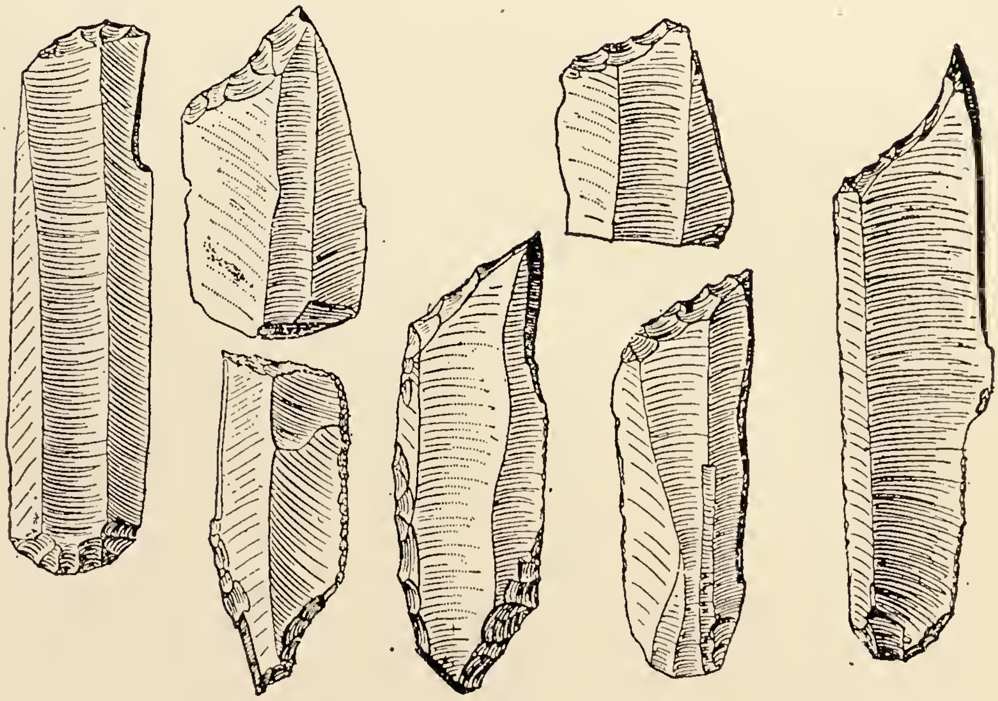
At what period the first experiments were made in fracturing flint is uncertain. Curious, implement-like stones have been found in deposits as early as the Miocene period, especially in the Cantal district in France, and these have been claimed by some to be of human manufacture. Few, if any, archæologists now accept these as tools, the great majority believing that these stones have been fractured by natural means. It is different, however, with the eoliths, first found on the plateaux in Kent, for they have a great number of advocates, though almost as many critics, while a still greater number of archæologists prefer to keep an open mind on the question. The age, too, of these eoliths is uncertain, for most of them have been found lying on or near the surface, while others have clearly been derived from earlier deposits. The balance of opinion is that they date from the middle of the Pliocene period.

The next oldest series of implements, accepted by more archæologists but still disputed by many, was first found by Mr. Reid Moir not many years ago, resting upon an old land surface just beneath a deposit

Plate XIII. Lower Palæolithic Tools

a. Aurignacian tools

b. Solutrean tools



c. Magdalenian tools

PLATE XIV. UPPER PALÆOLITHIC TOOLS

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of the Red Crag, at Ipswich, and called by him Rostro-carinates, because they ended in a kind of beak and had a keel down one surface. The use of such an implement is obscure, but according to Reid Moir they are an ancestral form, from which other and unquestionable implements have been derived by gradual modification and improvement. The Red Crag is considered by some geologists to be the latest bed in the Pliocene series and by others to be the earliest of the Pleistocene. The Rostro-carinate implements, if they are implements, date therefore from the close of the Pliocene period or the very beginning of the Pleistocene, and are, therefore, a little, but only a very little, older than the skull from Java and that of Peking man.

A little later than these, for they were found embedded in the Red Crag a few miles from Ipswich, are the Foxhall implements, which are generally accepted as of human manufacture. These were found several feet below the top of the Red Crag yet thirteen feet from its base in a pit at Foxhall, in a layer containing burnt flints, pot-boilers, bones and flint implements, that would have been useful for boring and scraping. The association of these flints with fragments of bones is important, and more so still is the evidence of fire, to which further reference will be made in the next chapter.

After this flint implements occur throughout the Pleistocene period in ever-improving form, until towards its close we find the beautifully made implements of St. Acheul type, which most authorities believe only ceased to be used in Europe with the oncoming of the Würm or last glaciation. Nearly all these implements were made from a nodule of flint by breaking off, first large flakes and then smaller and smaller flakes until at last the desired form was achieved. Thus most of the implements in this series are what are called core

implements, and these seem to have been the most general type in use, at any rate in Western Europe, until the closing phases of the Pleistocene period.

The core implements were succeeded in Western Europe by a series of implements made out of flakes, usually relatively large, struck from a core that was then discarded. These implements, worked on one side, but having for the other a relatively flat smooth surface, are those known as the Le Moustier type, to which reference has already been made. They occur in Western Europe with the remains of animals accustomed to a cold and even arctic climate, so it is concluded that their makers dwelt here during one of the cold phases of the Ice Age; it is held by many, and the view seems to be gaining ground, that this industry flourished here from the onset to the departure of the Würm glaciation. There are however, other flaked implements, which appear to be somewhat earlier, and some of those found in Germany are associated with the remains of animals that need a warm climate. This earlier flake industry is now called that of Levallois, and is thought to be an earlier phase of the industry of Le Moustier.

The generally accepted conclusion is that this flake industry was brought into Europe during a genial interglacial phase, probably that known as the Riss-Würm, and the distribution of the implements, both of its earlier and later phases, suggests that those responsible for it entered our continent from the East or North-east, that is to say that they came from the Asiatic plain north of the mountain zone. We have already seen that this industry, and this alone, has been found in association with that early type known as Neanderthal man, and this suggests that this Neanderthal species crossed Siberia during a genial interglacial phase, coming from the neighbourhood of North China, where, as

we have seen, Peking man, apparently an ancestral form, was living early in the Pleistocene period. It is believed by many that the majority of the Neanderthal men left Europe for North Africa, where many implements of this type have been found, when the rigours of the Würm glaciation became too severe, but there is some evidence that a few remained behind, especially on the north shore of the Mediterranean, until the climate had improved again.

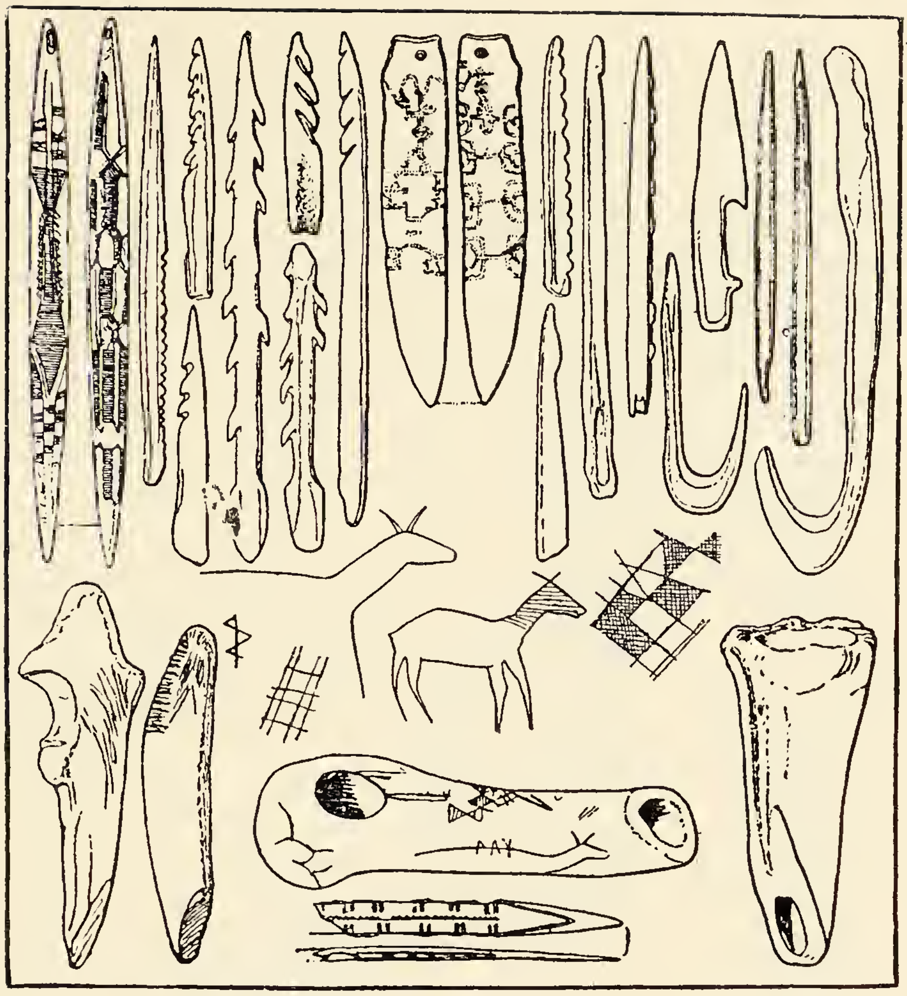
As the Würm glaciation was passing away modern man, as we have seen, entered Europe from North Africa. These men used a flake industry, but one in many respects differing from those of Levallois and Le Moustier. Their implements were smaller, usually long and narrow, and highly finished at one end into various forms for different purposes. Modern man, apparently unlike his predecessors, had developed a whole series of tools for different purposes, instead of being content with one, or at least two forms. On reaching Europe he seems to have come into contact with Neanderthal man, as, indeed, he appears to have done in Africa, for a number of implements found in France, and lately in Egypt and in this country too, show some characteristics of both types, the Le Moustier and the newly introduced industry of Aurignac. In these cases it is not always easy to determine whether they are Aurignac tools, showing a Le Moustier influence, or Le Moustier implements with features borrowed from the Aurignac industry.

The new industry entered Europe during the period known as the Achen oscillation and lasted, with a brief interval, until the close of the minor glaciation known as the Bühl. This interlude was caused by another group of modern men, who invaded Western Europe from the East, and came westward from Hungary and

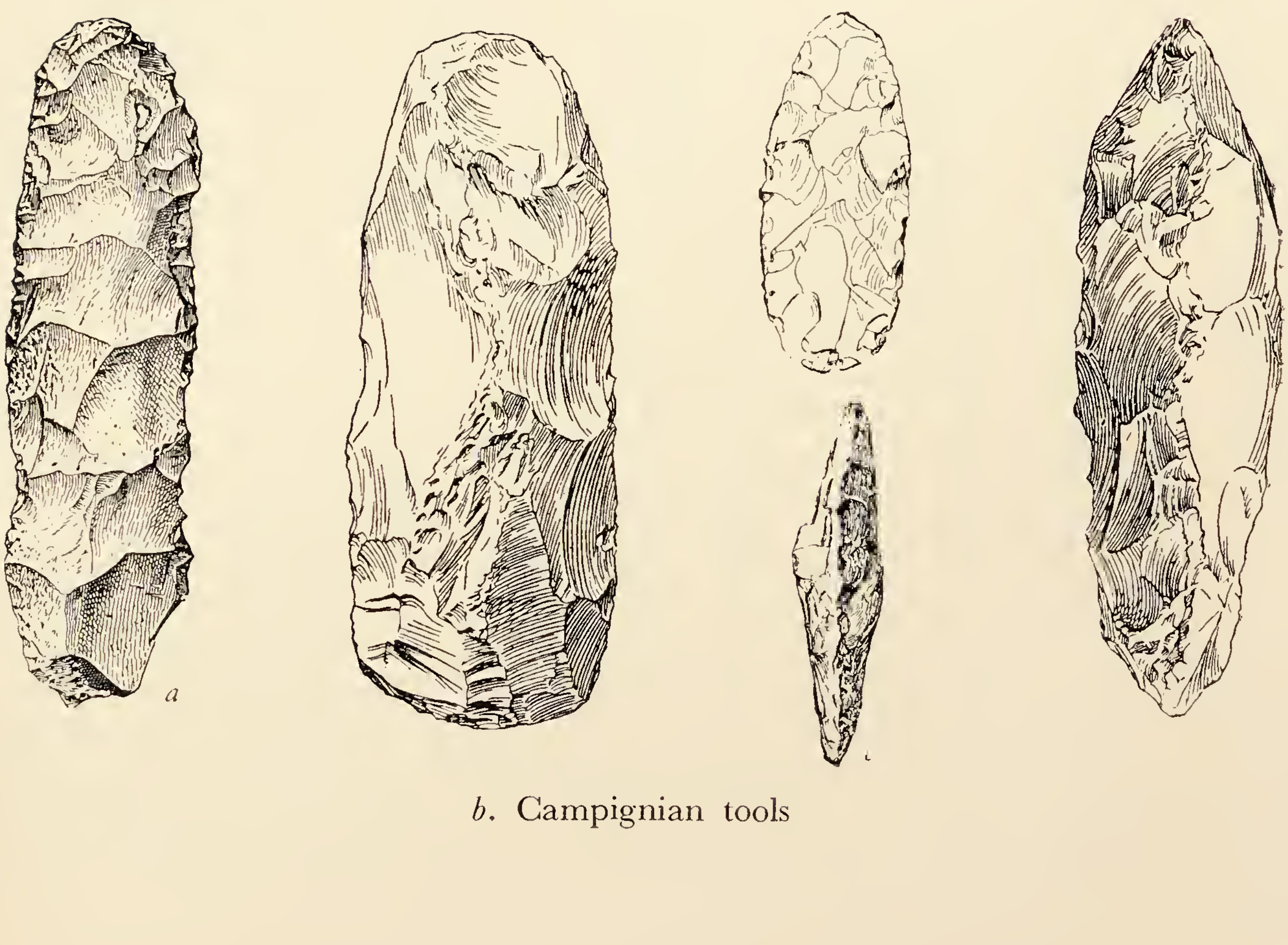
perhaps ultimately from Turkistan. These brought in an industry known as that of Solutré, and seem to have driven the men of Aurignac from their caves in South-west France, causing many of them to take refuge in the north of Spain. The industry of Solutré is mainly a flake industry, but some of their finest weapons, the laurel-leaf spear-heads, are very finely made core weapons. The men of Solutré roamed over most of North Europe and visited this country, probably in the summer time, though they did not dispossess its inhabitants; they did not cross the Pyrenees.

On the advent of the Bühl glaciation the climate changed from dry to wet, the grasslands were invaded by trees, the hoofed animals of the steppes departed for the East, where the forest failed to penetrate, and the hunters of Solutré followed them. After their departure the exiles in Spain returned to their old haunts. Owing to the scarcity of flint in their temporary abodes they had taken to making smaller implements and made many of their tools of bone. This applies only to those who returned to the South French caves.

It is by no means easy to determine the uses to which these Palæolithic tools were put. Some were undoubtedly weapons used in the chase of wild animals, and these will be discussed in the next chapter. Others, and among these are the majority of those found in the caves, were for other purposes. Some seem to have been used as small knives, either for cutting up meat or for carving on bone. Others are undoubtedly scrapers, used mainly for scraping fat off the skins of the animals slain, that they might be converted into clothes or blankets. A great number are thought to have been used for engraving upon fragments of bone and stone, and especially upon the walls of the caves those wonderful representations of animals, that have



a. The Maglemose industry



b. Campignian tools

PLATE XV. MAGLEMOSIAN AND CAMPIGNIAN TOOLS

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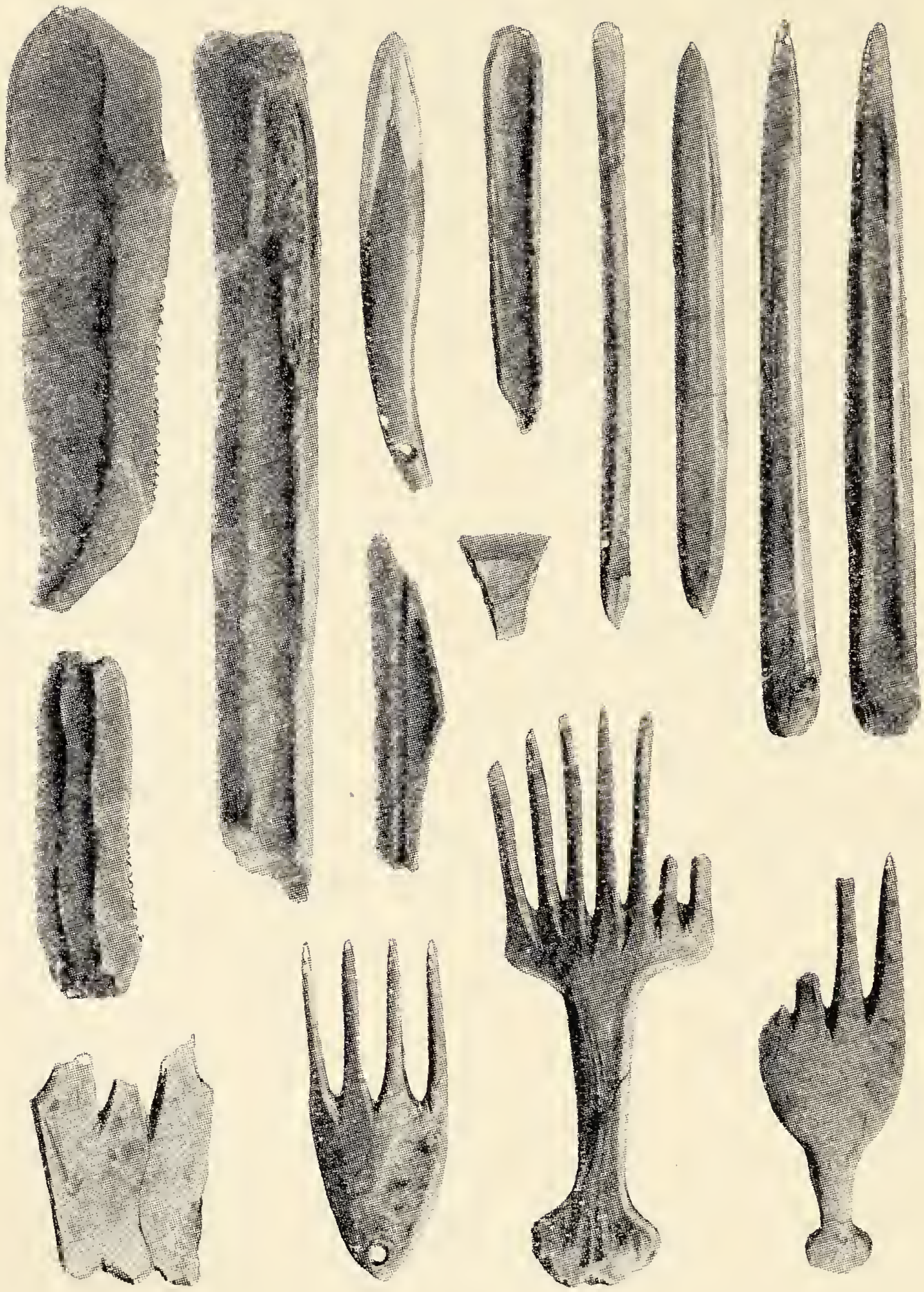

Plate XVI. Tools from the Shell-mounds

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aroused the admiration of all who have seen them, and which will be described in a later chapter.

After the end of the Bühl glaciation the climate became milder but damper, and the woodlands spread everywhere except to the dry chalk and limestone lands. The people became separated into small groups and lived for the most part on fish and shell-fish, and each group developed its industry in its own way. A fresh group of people entered Spain from North Africa, where the grasslands were giving way to deserts. These newcomers used implements of very small flints, apparently set in wood, and seem to have kept mostly to limestone areas and to sand dunes. Meanwhile other industries, sometimes using bone for most purposes, others using core implements, came in, apparently from the East, and settled in various parts, but chiefly along the shores of the Baltic and North Seas.

The period following the Bühl glaciation is known as the Mesolithic or Epipalæolithic Age, and is not so well understood as those which preceded and followed it. It was a time of poverty and hunger, of many distinct cultures and industries, each occupying its own special region. It is believed to have lasted for a long time, in some regions for as much as four thousand years, and all the time its low civilization was declining and the people were becoming poorer and more miserable. As the woods spread over Europe, the more enterprising folk had departed, and the remnant left behind, lacking initiative at the beginning, degenerated fast in the miserable conditions under which they were compelled to live.

The tools of the Mesolithic Age are in many cases more difficult to explain than those of the preceding periods. Doubtless some were used for hunting weapons, but some small axe-like tools were probably used for split-

ting wood, while others, larger and more roughly made, sometimes with sharp points, known as Campigny celts or Thames picks, were probably used as hoes for digging up roots. A few small tools from this period, found mainly in Scotland and on the shore of the Baltic Sea, are believed to have been used for scraping limpets off the rocks.

The wretched conditions of the Mesolithic Age lasted, as we have seen, for a long time, and might have continued indefinitely had not a new and higher civilization been introduced from elsewhere. It is not possible here to trace the course that this new culture took or to define the dates at which it reached different parts of Europe. We must be content to state that it took its rise in the Near East, in Asia or, as some people think, in Egypt, some time before, but probably not long before 5000 B.C., that it reached Eastern Europe before 3000 B.C. and had penetrated to all but the most remote parts of the continent some centuries before 2000 B.C. This civilization, known in Western Europe as that of the Neolithic or New Stone Age, introduced a new feature into the working of stone, the process of grinding or polishing.

Where the art of grinding and polishing stone first arose it is uncertain, for axes thus treated have been found in the earliest civilizations discovered in Egypt and Mesopotamia, while ground axes in hard crystalline stone, which look as though they were the prototypes of the others, have been found, usually without associations, in Asia Minor. Somewhere in that region the art of grinding and polishing stone arose, and was used mainly for axes. Axes of this type are always found in association with evidence of agriculture, and suggest that with grain growing the art of the woodcutter and the carpenter arose. Grinding and polish-

ing is seldom used except for axes and perhaps for the edges of hoes, but along with it came the art of very fine flint work, which continued to improve until after the introduction of metal.

It will be seen from what has been stated in this chapter that while wood, bone and stone only were used for the manufacture of tools only a very limited variety was possible. A number of weapons for the chase were made, as we shall see in the next chapter, but tools were mainly confined to scrapers, borers, gravers, hoes or picks and axe-heads. How the last-named types were hafted is not quite clear. It has been suggested that the head of the axe was inserted in a hole cut in one end of the handle, which had been left wider for this purpose. In the Swiss lake-dwellings the butt of the axe-head was inserted into a place cut from the butt of an antler, and this in turn inserted into a hole in the handle; this antler "sleeve," as it is called, served to lessen the jar caused by the blow, and thus prevented the handle from splitting so readily. Many of the hoes and picks were probably fixed into the split end of the handle by means of raw-hide lashings. In addition to these tools, stag antlers were frequently used as picks, and numbers of these have been met with in the flint mines at Cissbury, in Sussex, and at Grime's Graves, as well as in the bottom of the ditch that surrounds the great temple at Avebury.

CHAPTER VI

THE DISCOVERY OF FIRE

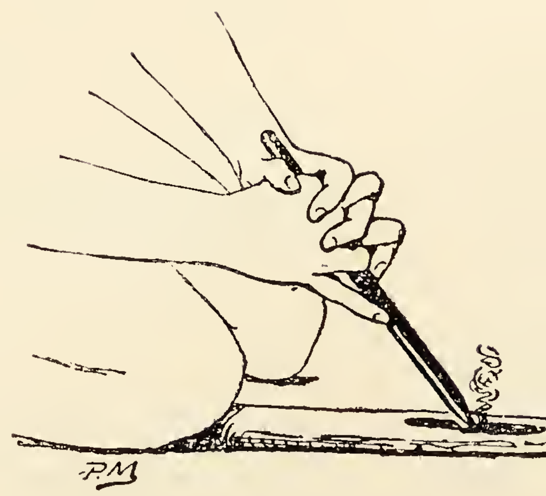
One of the earliest discoveries made by man was the use of fire and subsequently the production of that element. All wild animals dislike fire; they are afraid of it because they are unable to control its ravages. So it is that, if fires be lit around an encampment, dangerous animals will keep at a distance. Man seems early in his career to have overcome this fear and to have harnessed the element to his own use. How and when this happened is uncertain.

According to Sir James Frazer, who has made an exhaustive study of the myths and legends relating to the discovery of fire, there is a general belief that for a time men were ignorant of the use or even of the existence of fire, then came a time when they had become acquainted with it and used it to warm themselves and to cook their food, lastly they discovered methods of kindling it. From this he argues that mankind has passed through three stages, the fireless age, the age of fire used, and the age of fire kindled.

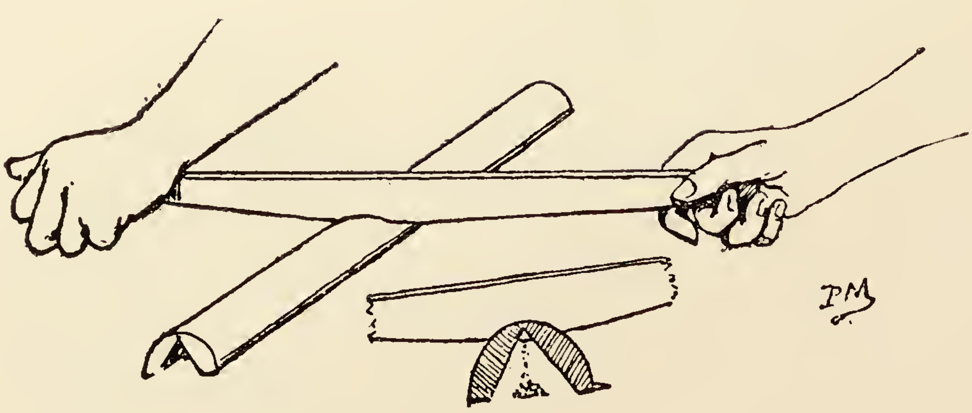
If indeed there were these three stages in man's development, the first must have been of relatively short duration, for, as we have seen in the previous chapter, at Foxhall, near Ipswich, some flints, which most archæologists recognise as implements, were found in the same layer as fragments of bones, burnt flints and pot-boilers. Thus among some of the earliest known tools we have found the presence of fire, and this at a time that must

a. Pot-boiler from Foxhall

b. The fire-drill



c. The fire-plough



d. The fire-saw

PLATE XVII. SOME FIRE-MAKING APPLIANCES

[*Face pag*

a. Flint and pyrites

b. Fire piston

c. Flint and pyrites

Plate XVIII. Other Fire-making Appliances

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be considered as at the beginning of the Pleistocene period, and would by some be relegated to the closing phase of the Pliocene. If, then, we accept the evidence from the Foxhall pit, and the conclusions reasonably deduced from that evidence, we must admit that men, earlier than those that left the Java and the Peking skulls, knew how to make use of fire, and had reached at any rate to the second stage that Frazer has postulated. Late in 1931 the Abbé Breuil reported that Peking man had used fire.

The presence of bones as well as of flint implements beside the burnt flints, and even more the presence of pot-boilers, suggests that the men of Foxhall were using their fire for the purpose of cooking their food. This raises the question of the origin of cooking. Charles Lamb relates that, according to a Chinese manuscript, mankind ate their meat raw for the first seventy thousand ages. One day, however, a swine-herd, Hoti by name, went out into the woods, leaving his cottage in the care of Bobo, his eldest son, who began to play with the fire and soon set the cottage alight, thereby killing nine small pigs that were housed there. Noticing a curious smell, which he suspected arose from the carcases of these animals, he touched one of them and, burning his fingers, put them in his mouth, and he liked the taste. He repeated the process several times, licking his fingers on each occasion, and began eating the carcase when his father returned. In spite of his anger at the destruction caused by his careless son, he yielded to the latter's entreaties that he should taste this novel food, and became equally enchanted with it. To produce similar food he repeatedly burnt down his house soon after his sow had given birth to a litter, and in this way the good news in time passed to the other inhabitants of the Middle Kingdom.

We need not take Lamb's account too seriously, or believe that he really derived it from a Chinese manuscript, but we may well believe that it was some similar accident, in which an animal perished in a fire, by which it became cooked, that led men to substitute cooked for raw flesh for their meals, thus providing a very important use for fire. Lucretius suggested that man may have obtained fire in the first instance from a conflagration kindled by lightning, and that he may have learned how to make fire by noticing branches of trees set alight by rubbing against one another in the wind. Tales told by primitive peoples suggest both these origins, either of which is possible. Mr. Henry Balfour informs me that many years ago he saw a manuscript, unfortunately never published, in which a traveller in the Seychelle Islands stated that he had witnessed a fire being kindled by two branches of a shrubby bush being rubbed together by the action of the wind.

In some such way, then, men learned of the existence of fire, and how to kindle it, and we may well believe that no long period elapsed between its first use and the discovery of the means of producing it. There are many simple ways of kindling a fire still in use by primitive peoples, and the methods used by more civilized folk have resulted by a gradual process of improvement from one or other of these. The various methods are thus classified: Wood-friction methods, Flint-and-pyrites method, Flint-and-steel method, Quartz-and-iron method, Optical methods, the Compressive method and the Chemical methods. Such is the classification used in the Bryant & May Museum of Fire-making Appliances, in which is exhibited an exceptionally fine collection illustrating the various methods of kindling. For practical purposes we may treat them as Wood-friction, Stone-and-iron, Compressive, Optical and Chemical.

There are three ways of producing fire by wood-friction, by using the fire-drill, the fire-saw and the fire-plough. In each of these heat is generated by friction, as in the case of the rubbing branches already cited, and with the aid of blowing and dry tinder the heat is converted into flame.

The fire-drill is the commonest implement used for this purpose. In this method a blunt-pointed stick or "drill" is twirled between the palms of the hands in a slight hollow in the side of another stick, called the "hearth." In some cases the "drill" is rotated by mechanical means, either by a leather thong, pulled rapidly backwards and forwards, or by a bow. The fire-drill is used over the whole world, except in the Pacific Islands, especially in North America, Central and South Africa, India, the East Indies and Australia. The fire-drill was used by the ancient Aryans in India, as we learn from the Vedic hymns, and it is still used by them for ceremonial purposes. They call it *pramantha*, and the nineteenth century philologists conjectured that this word had given rise to the name of Prometheus, who according to Greek myth stole fire from heaven and gave it to mortal men. This suggestion Sir James Frazer believes is also a myth.

The fire-plough is a stick, similar to the "drill," but rubbed rapidly up and down upon the hearth. It is made of a piece of *Hibiscus* wood, which is very soft, and is used in New Zealand and in many of the islands in the Pacific Ocean. One specimen has been found in North Queensland, but it is otherwise unknown in Australia. The fire-saw is a piece of sharp bamboo, drawn rapidly backwards and forwards across another piece. It is used in South-east Asia, the East Indian Islands and has been met with in Australia.

The stone-and-iron methods are all based upon the same principle, striking a hard stone with a piece of iron or steel. The simplest form is that known as the flint-and-pyrites method, in which a lump of iron pyrites is struck by a more or less pointed flake of flint. The sparks thus generated are allowed to fall upon tinder, which is then blown into a flame. This method is used by the Eskimo in Greenland, it was used in Suffolk until about 1827, and it was made use of in prehistoric times here and elsewhere.

The quartz-and-iron method is similar, for in this case a piece of quartz was struck by a pointed piece of soft iron. This method was much used by the Vikings, and the quartz stones used for this purpose have been found in great numbers in all the Scandinavian countries, and occasionally on the shores of Scotland and Ireland.

The flint-and-steel method clearly arose out of the flint-and-pyrites method as soon as the knowledge of working iron made steel available. It then superseded the more primitive method in all civilized countries, where it often replaced the fire-drill. Although it has usually been superseded by matches, it is still in use in many parts of the world, such as North Africa, China, Albania and large parts of the Turkish empire. A number of flint strike-a-lights were made as late as 1924 by Mr. Fred Snare of Brandon, Suffolk, for export to Spain, South America, Borneo and other lands. The use of flint-and-steel has been revived in this country in recent years, in association with petrol, and such strike-a-lights are now much used and were very popular in the trenches during the War.

The optical method is the use of a lens to concentrate the rays of the sun upon the tinder and so to set it alight. It has been little used except among the Chinese, though it has occasionally been employed in this country and in France.

The compressive method is very unlike the others and is found in use in a small and very restricted area. It consists of a piston, holding in a small cavity in its face a tiny fragment of tinder. This fits tightly into a small cylinder or tube of bone, wood, horn or metal, with a closed end. The method of working it is to press the piston rapidly into the cylinder, when the compression of the air gives rise to heat, which lights the tinder as soon as the pressure is removed. It is used by the natives of Burma, Sumatra, Borneo and the Phillipine Islands, and was patented in this country in 1807 as a toy.

Lastly we come to the chemical methods, first used towards the end of the eighteenth century. These include a number of "Instantaneous light contrivances," among which the more notable are the "Phosphoric taper," the "Phosphorus-box," the "Electro-pneumatic lamp," the "Pyrophorus" and the "Instantaneous light box." These were followed by the Prometheus match, patented by Samuel Jones, of London, in 1828, after which a number of other matches of different kinds were produced.

It is clear from the above summary that chemical methods have only been in use for about a century and a half, that optical methods have been rarely used and then only among civilized people, while the compressive method has a very restricted range and there is no evidence of its great antiquity. The other methods are clearly derived from the flint-and-pyrites and the simple fire-drill.

The flint-and-pyrites method can be shown to have a respectable antiquity, since nodules of pyrites, apparently used for this purpose, have more than once been found with interments in round barrows of the Bronze Age. So far no evidence of this or of any other method of

kindling fire has been found with Palæolithic remains, but, as we have seen, we seem to have a satisfactory evidence for the use of fire by the men of Foxhall, while charred wood and the remains of hearths have been found more than once with remains dating from an early phase of the St. Acheul and from all subsequent periods. Though pyrites has not been found or recorded from sites earlier than the Bronze Age, we must not assume that this method has not an earlier origin.

From the nature of the material early evidence for the use of the fire-drill is entirely lacking, but the ceremonial use of the *pramantha* by the Hindus shows that it is an old-established custom. It has been suggested by philologists that the Greek word for fire, pyr (πύρ), represents the sound of the whirring of the fire-drill. This may be so, and in that case we may ascribe a like origin to the cognate words, the Umbrian *pir*, the Armenian *hur*, the Old High German *fiur* and the English *fire*. Other Aryan languages have words for fire unrelated to these. Thus in Sanskrit it is *agni*, in Lithuanian *ugnis*, in Old Slavonic *ogni* and in Latin *ignis*. These words bear no resemblance to the sound of the fire-drill. On the other hand the Eskimo, who still in Greenland use the flint-and-pyrites method of kindling, call fire *ignek*. Among the Western Eskimo, who live in and near Alaska, the word is *knik*, *knok*, *knákhk*, *k'núk*, *kanuk* or *ik'nuk*. This represents very clearly the sound of flint striking a lump of pyrites, and, though the Western Eskimo now use a fire-drill, evidently borrowed from their American Indian neighbours, their word for fire suggests that, like their eastern relatives, they once depended upon the flint and pyrites.

These words for fire among the Eskimo remind us of the series of Aryan words already quoted, *agni*, *ogni*,

ugnis and *ignis*. Is it possible that these, too, indicate the sound of the flint and pyrites nodule?

The flint-and-pyrites method is rarely employed except by the Eskimo of Greenland and the inhabitants of Tierra del Fuego, at the other extremity of the western continental mass. This leads us to suspect that its origin must go back into the mists of antiquity, so that the balance of evidence is in favour of this, rather than the fire-drill, being the earliest device used by man for the production of fire.

As we have seen, fire was first used to give warmth and to cook food, but before man had advanced very far on the road to civilization he found another use for it; this was to give light. During the long cold winters of the Ice Age, especially during the last or Würm glaciation, many men took refuge in caves. The walls of these were decorated with mural drawings and paintings by the earliest modern men to reach Europe, and, as we shall see these drawings were executed, not with a view to the adornment of the walls of their dwellings, but as a magical process to increase and multiply the supply of animals for food. That this was the real purpose of these works of art is clear from the fact that many of them are in deep recesses in the caves, where no ray of daylight has ever penetrated.

That such elaborate and well executed designs were carried out in complete darkness makes us suspect that our early forerunners had some means of illuminating the deep recesses of their caverns with a light however feeble and flickering. Some sort of lamp must have been used by these early artists, and luckily we are able to form some idea of its nature, for in 1899 a small stone object was found in the cave of La Mouthe in the Dordogne. This was extracted from an undisturbed layer containing implements of the La Madeleine indus-

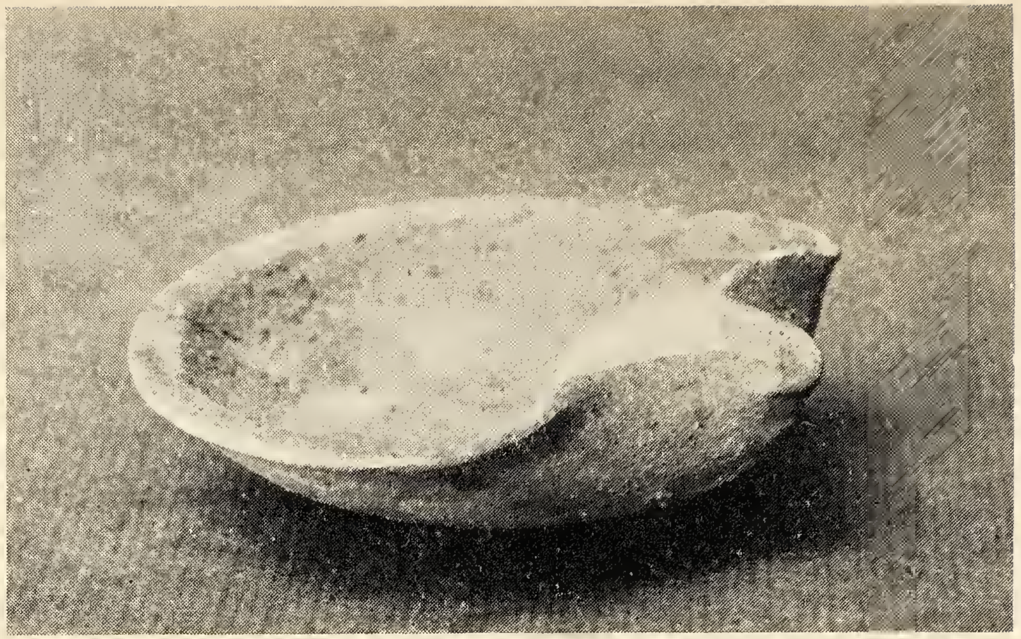
try, sealed down and separated from the overlying Neolithic deposit by an unbroken layer of stalagmite. This object was a pebble of fine close-grained sandstone, oval in outline but prolonged at one side into a kind of handle; one side of this pebble had been hollowed out to form a shallow bowl, while on the other had been engraved a rough sketch of the head of an ibex. At the bottom of the bowl was a black deposit, which was submitted for chemical analysis to M. Berthelot, who reported that it much resembled the residue left by the combustion of animal fat. That this was a primitive lamp there can be little doubt, and stone lamps, very similar in form, are still in use among the Eskimo. Quite recently Dr. Absolon has found, on a camping-site at Vestoniče, in Czecho-Slovakia, a part of a wolf's skull, which was, he believes, used as a lamp.

In later times similar lamps were made by hollowing out lumps of chalk, and several such lamps have been found in the galleries of the flint mines at Cissbury, in Sussex. These date either from early in the Neolithic Age, or more probably from a late phase of the Mesolithic Age.

It has been thought by some that various shells, notably the scallop shell, were frequently used in early times for lamps. Such shells have been found in graves, both in prehistoric and in Roman times, and these are thought by some to have been lamps; in Egypt large cockle-shells have been found in graves, sometimes lined with a greasy substance, which is believed to be the remains of oil or fat.

Lamps made of rough pottery were early in use in Greece, in Etruria, at Carthage and among the Phœnician settlements in Malta. These are all shallow earthenware dishes, usually pinched up at one point to form a niche to hold the wick; those found in Malta are furnished

a. Ancient Maltese



b. Ancient Maltese

c. Carthaginian

d. Greek

PLATE XIX. FOUR EARLY LAMPS

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a. Roman lamp

b. Mediaeval lamp from Egypt

c. Modern Maltese lamp

PLATE XX. TWO ANCIENT AND ONE MODERN LAMPS

with two such niches. Similar lamps were in use in Malta as late as 1914; they were placed as a rule in a hollow earthenware stand, with an opening on one side, and could be set on the top of it when more light was required.

Later on the sides were curved over more and more, until the top was completely closed and the wick placed in a tube at the end, while a handle was sometimes placed at the other end. These developed into a jug-like form during the Middle Ages in Egypt, where they were made of blue faience.

Many later forms are known, while others of extremely primitive type survived in backward parts of the world until our own day. Standing lamps, for colza oil, and then for petroleum, are a relatively recent innovation, and were unknown before the nineteenth century.

CHAPTER VII

THE HUNTER'S WEAPONS

SINCE our earliest forerunners lived mainly on the fruits of the chase, supplemented to some extent by collecting wild berries, nuts and roots, it is obvious that a variety of weapons was necessary to enable them to bring down their prey. Curiously enough during the earliest periods we have few implements that we can definitely class as weapons, though there are many that are certainly tools; still weapons they must have had, most of which have probably disappeared since they were made of perishable materials, while it is probable that the early hand-axes, or some of them, were used for killing animals, though the exact method of their use is uncertain.

Though weapons were first used for the most part for slaughtering animals needed for food, they were also employed, when occasion warranted it, for killing men who had for any reason made themselves objectionable. It is not, therefore, easy, in dealing with early days, to distinguish between weapons for war and for the chase, and, in fact, even to-day they bear a close resemblance to one another. It is not, however, until the dawn of the age of metal that they begin to become sharply differentiated.

Weapons of offence, whether for war or for the chase, have been classified under five chief headings, according to whether they were used for: stunning or crushing; piercing; cutting; entangling or capturing; and perfor-

ating or shattering. These are further divided into two groups, those used in the hand and those thrown as missiles. We must further distinguish forms of apparatus used for hurling missiles. Besides these there are a few other weapons, if they may be so called, used for capturing fish.

Among stunning and crushing weapons the earliest to be used must have been clubs and stones, for these were ready to hand and needed no making. Even the great apes have been known to wield long branches, torn from the trees by the wind, and many cases have been recorded in which they, and monkeys of lower degree, have thrown nuts, sticks, stones or any other missiles that were handy, at those who have intruded upon them. We can well imagine, therefore, the earliest human beings using some forms of clubs and missiles to enable them to kill their prey, but, having reached the human or tool-making stage, we must also conclude that they were able to fashion these weapons the better to meet their needs.

We have no direct evidence of the early use of clubs, for they were, apparently, made of perishable materials, but a number of different kinds are still in use among primitive peoples. They are usually made of wood, though occasionally of bone or stone, and sometimes of wood with a stone head, though the latter type is often called a mace. Wooden clubs of various kinds, plain and straight, knobbed, root-ended, mushroom-headed and of other forms, are used to-day, mainly in Australia and in the islands of the Pacific Ocean, where a great variety are to be found in the Melanesian and Polynesian islands. Some of the most interesting types come from Fiji, but they are found in use also in the New Hebrides, New Caledonia, the Solomon Islands and New Guinea, as well as in many other groups of

islands; the characteristic wooden club of New Zealand, the *pai-haka*, is shaped something like an axe. Some of the Redskins of North America once made use of a short flat club with a round knob at the end, occasionally armed with a spike of antler, while in Africa the only wooden club employed is the short knobkerrie, used more as a missile than as a striking weapon. Some consider the Irish shillelagh as the survival of a simple form of club.

Bone clubs are more rarely used, for a bone, long enough for the purpose, would usually break in half with a hard blow. The best known type of bone club is the *mere*, used by the Maories of New Zealand; it is a short, flat and somewhat racquet-shaped plate of whalebone. Clubs of bone and ivory are used by the Eskimo; these often consist of the solid portion of a walrus tusk, perforated at one end for a thong of hide. Clubs of elephant ivory are occasionally used in Africa. It is just possible that the implement, made from the thigh bone of an extinct elephant, that was found in the Piltdown gravel, may have been used as a club. This, however, seems unlikely, since it is too short, its girth is too great to be held conveniently in the hand and one end is roughly pointed.

Though stones are not infrequently used for weighting the ends of clubs, especially in New Guinea, clubs entirely of stone are not common, for the labour involved in making them is disproportionate to their value. Short stone clubs have been used by some of the North American Indians, the *mere* of the Maories, described in the preceding paragraph, is sometimes made in stone, and the Chatham Islanders, who are closely allied to the Maories, use a similar weapon, though they perforate the blade end of the club, while the Maories make the hole through the grip end. There are imple-

ments, dating from the Neolithic Age in Europe, which have been claimed by some archæologists to be stone clubs.

Short clubs with elaborate heads are usually called maces, and are generally made of metal or have metal heads. They have been used in most countries in the Old World in past days, but generally in civilized times and were mostly used as warlike weapons. During the Middle Predynastic or Gerzean phase in Egypt the people used a mace with a pear-shaped head, often elaborately carved. These seem to have been introduced from South-west Asia, where their use goes back to the earliest times. A number of perforated stones have been found in Neolithic and Copper Age settlements in various parts of Europe; these are often called mace-heads, but their real use is uncertain.

Another kind of club, usually called a "life-preserver," consists of a head of stone or metal attached by a thong to a short haft. Some of the North American Indians used a weapon of this kind, with a head of stone enclosed in a leather bag; the Eskimo used a simpler form, consisting of a perforated stone, strung on a strip of hide. During the Middle Ages more elaborate forms of this weapon were used in Europe, where they were called "Holy water sprinklers," or "Flails." The head was of iron, into which spikes had been inserted.

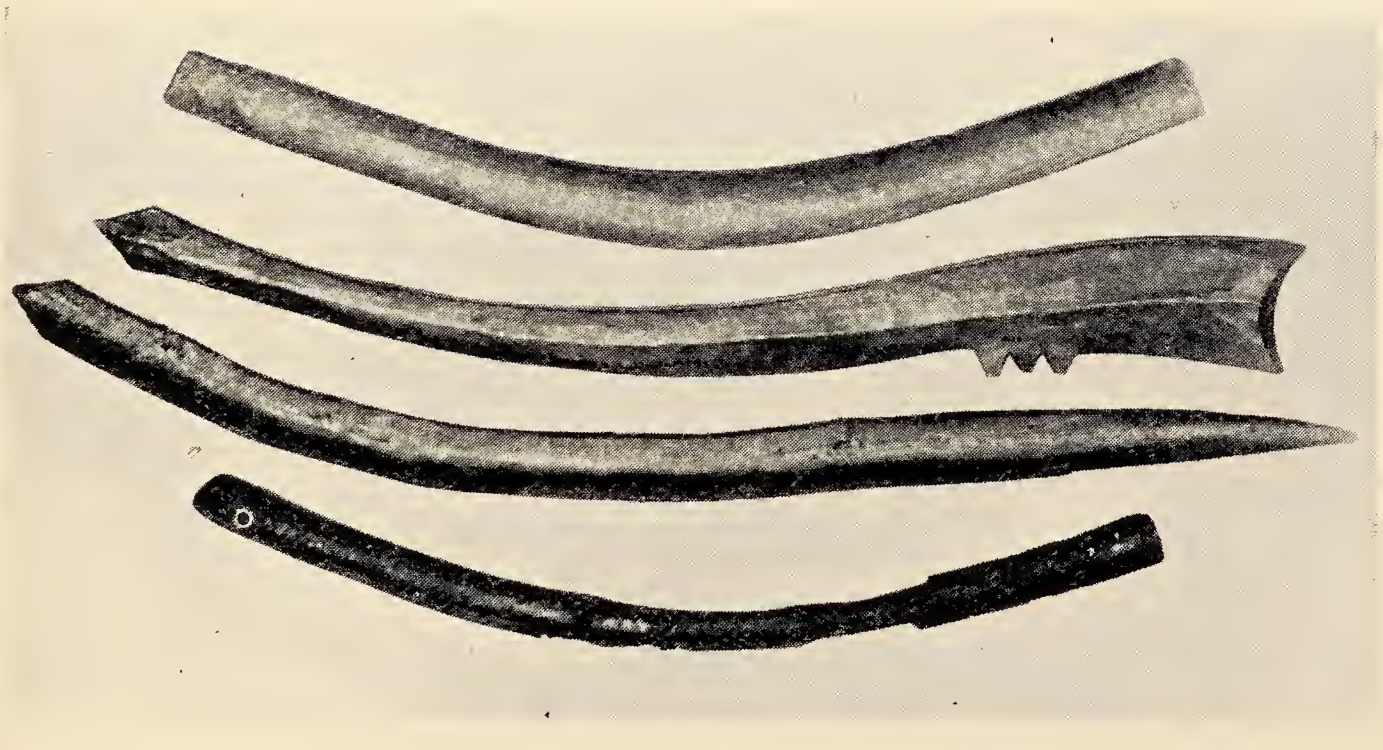
Some short clubs are used as missiles, and we have already made reference to the African knobkerrie, which is used in this way. The Australians usually throw their *waddies*, both straight and curved, while the Fijians do the same with their *ulas* or "belt-clubs."

By far the most interesting of these missile clubs is the *boomerang*, best known from Australia. Some, like the "come-back" boomerang, return to their owner after flying through the air. This is a small light weapon

of wood, used mainly for hitting birds and small animals, and frequently employed only for the display of skill. The fighting boomerang is a much heavier weapon and does not return. The "come-back" boomerang is said to have been used by some tribes in India. Of the other type, missile sticks, very similar to those used by the Australians, were in use among the ancient Egyptians for killing water-fowl, and similar weapons have been recorded as in use in recent times in Abyssinia and on the Upper Nile. Non-returning boomerangs have been found in use in many parts of India, in Guzerat and in the Bombay and Madras Presidencies, while a throwing stick of a similar type is used in North America by the Moki Indians. There seems little doubt that the boomerang of the non-returning type was used in Upper Palæolithic times, for what appear to be these weapons are depicted in a wall-painting in a cave at Niaux, in the Pyrenees, where several such weapons are to be seen, one of them bearing a close resemblance to a weapon of this type found in an Indian mound in Arizona. Curved objects of bone, figured by Girod and Massenat, have been supposed by Schoetensack to be boomerangs, and a similar claim has been made for another bone object from La Madeleine, figured by Lartet and Christy, which bears a decoration recalling the outline of a boomerang. Neither of these pieces of evidence are, however, very convincing.

We now come to missiles, which, with the exception of throwing clubs and boomerangs, are usually stones. As we have seen already, man from the earliest times must have thrown stones, since apes and even some of the monkeys have been known to do so. As a rule any kind of stone, though preferably a rounded pebble, would serve for this purpose, and such stones would not readily be recognised if found with the remains of pre-

a. Bone clubs



b. Wooden clubs

PLATE XXI. CLUBS

[*Face page* 62

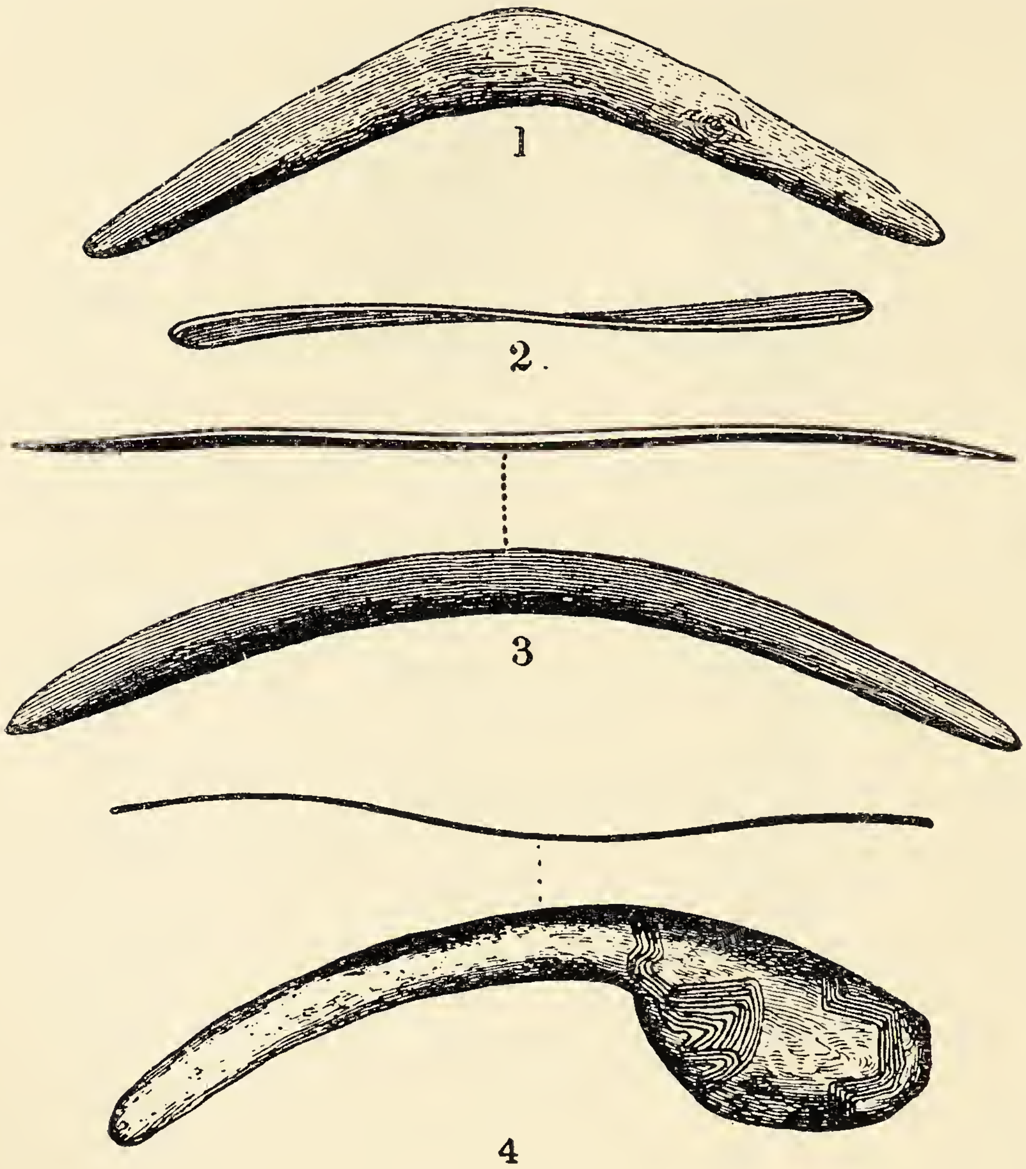


Plate XXII. Boomerangs

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historic man. We have seen in an earlier chapter that what were believed to be pot-boilers were found among the remains in the Foxhall pit; these might also have served for throwing but the most convincing evidence that we possess comes from the Le Moustier industry in the cave of La Quina, where sixty-six spherical balls of limestone were found, evidently shaped by the hand of man, and varying in diameter from one and a half to three and a half inches. These Macalister believes were used as sling stones, though Sollas records the view that they had been used as *bolas*, a weapon to be described later. Stone throwing was a recognised means of warfare among the Greeks and Trojans, and was employed by the Vikings, while the Hebrews used it as a method of execution.

Stones were sometimes thrown by hand and sometimes by slings, which were generally made up of two cords or thongs, each attached to a wider short strip of material, which formed the pouch to hold the stone. The nature of the material is such that it cannot have survived from prehistoric times, so that we are unable to determine how early the sling came into use. The ancient Egyptians used slings and stones to scare away birds from their crops, David slew Goliath by using this weapon, and the inhabitants of the Balearic Islands were such experts in its use that the Romans gave them this name from their skill with it. Slings were used by the Assyrians, Persians, Phœnicians, Hebrews, Greeks, Romans, Vikings and Anglo-Saxons, and until recent times they have been used in India, Java and many other parts of Asia.

Among capturing and entangling weapons the most striking is the bolas. It consists of three, or sometimes two, heavy balls, connected with each other at a common centre by stout thongs several feet in length. The balls

were originally of stone, with a groove for the thongs to lie in, but now each ball, which may be made of wood, stone or metal, is enclosed in a pouch of hide. One ball, smaller than the others, is held in the hand, while the others are whirled round in the air at the end of the thongs. When sufficient velocity has been attained, the ball in the hand is released and the whole apparatus goes flying through the air. When it strikes the animal chased, the thongs wind themselves round its legs, so bringing it to the ground. It was formerly used by the Patagonians and by the Indians of the pampas of La Plata, but it is now often employed by the Spaniards and half-castes of those regions. As has been seen, it has been claimed, not however with much probability, that the limestone balls, found in the cave of La Quina, were used for this purpose. It is more likely that certain spherical balls, hollowed with grooves in various directions, found in considerable numbers in Scotland, though of uncertain date, may have formed part of some such weapon.

Another weapon of the same type is the lasso, which consists of a long rope or platted raw-hide thong, with a noose at the end. The noose is whirled round the head and then let go like the bolas, except that the other end of the rope is retained in the hand. The object is to implant the noose round the neck or the legs of the animal hunted. It was used for hunting both in North and South America, where it is still employed by cowboys to capture their cattle. It was used, too, by the ancient Mexicans and Peruvians against their enemies, and a small noose of the same type is employed for a similar purpose by the Australians, and for the purpose of murder by the Thugs in India. From the perishable nature of the material it is impossible to ascertain whether the lasso or the noose were used by early man.

We now come to piercing weapons, of which there is a great variety, such as spears, lances, javelins, daggers, stilettos, dirks, rapiers and bows and arrows. Spears and lances, which are only long and heavy spears, are intended to hold in the hand while thrusting into the body of the enemy. They have been used mainly as warlike weapons, and have usually metal points. Macalister doubts whether any spears were in use until the Metal Age, when a bronze, or possibly a copper, dagger was placed on the end of a long shaft for use as a spear. On the other hand what appears to have been a wooden spear was found, as we have seen, at Clacton-on-Sea, in a deposit that is believed to be of Le Moustier date, while some of the still earlier implements of late St. Acheul date, have the butt end so thin as to suggest that they were intended to be inserted in the split end of a haft and so used as a spear. We must, however, remain in some uncertainty as to whether any true spear-head was in use before metal had become well known. After that spears and ultimately lances became important weapons of war, and were used by all the great nations of antiquity, and developed into the great lances used by the mailed and mounted knights of the Middle Ages.

Javelins are much lighter than spears and often, though not invariably, shorter, for they are intended to be thrown as missiles and not to be thrust with the hand. Many of those now in use in the islands of the Pacific Ocean, in America and in some parts of Asia, are made entirely of wood, or are pointed and barbed with bone, ivory, or sometimes with the teeth of sharks. The simplest form, a slender wooden pole with a point, sometimes hardened in the fire, is found in New Guinea, Australia and some parts of America. According to Tacitus similar wooden spears, with the points hardened in the same way, were used by some of the German

tribes in the first century of our era. Stone-headed spears have only gone out of use within recent years in North and in South America, while in the Admiralty Islands the ends are tipped with large pointed flakes of obsidian, lashed to the end of a light reed shaft, the binding being coated with a layer of native gum. Spear-heads of bone and ivory are used by the Eskimo.

It is sometimes thought that flint-tipped javelins were used by the people of Le Moustier, but this is far from certain. A number of triangular pointed flakes were found with the remains of this industry in the caves of La Chapelle-aux-Saints and at Combe Capelle. They were at first thought to have been used as javelin points, but it was felt that, if that had been their use, it was unlikely that so many would have been found discarded in the caves. Later MM. Bouyssonie and Bardon suggested that those found at La Chapelle-aux-Saints had been used for splitting bones to obtain the marrow, since many bones so treated had been found among the refuse in the cave. In the Upper Palæolithic Age the javelin was undoubtedly used, though the best examples have only been found among the remains of the industry of Solutré. Here the javelin points are beautifully worked, and sometimes attain a great size.

Javelins are usually thrown by hand, but some primitive peoples are found using a contrivance, known as the spear-thrower, which enables them to be sent for a greater distance. Spear-throwers are of two kinds. One is a short length of cord, called a "becket" or "brocket," and is used in exactly the same way as a sling for hurling a stone. The other is a rigid rod or flat stick, usually of wood, with a peg or ledge against which the end of the spear can rest, and the spear-thrower is used in such a way that the arm, so to speak, has an additional joint.

The cord spear-thrower is still used in New Caledonia and the New Hebrides, where it is known as the *ounap*, while the "brocket" is used in Australia, New Guinea, in Central America, as well as in the Arctic and sub-Arctic zones of the American continent. The Australian spear-thrower, called the *woomera* or *wummera*, is about one and a half to two feet long, and has a projecting peg of wood, bone or tooth, to fit into a pit, which is hollowed into the end of the spear. Sometimes it is a straight cylindrical stick, while at others it is flat and blade-like, with the peg fixed either into the flat side or on the rim. The spear-thrower of Arctic America, used mainly by the Eskimo, is very similar to that of the Australians, but the grip is carefully carved to fit the hand, sometimes with a groove for the spear-shaft ending in a peg for the end of the spear. A great many spear-throwers, very closely resembling those of the Eskimo, have been found associated with the industry of La Madeleine, especially in the caves of the Dordogne; as many as thirty-four examples have been taken from the middle La Madeleine layer of Laugerie Basse. They are carved out of bone and ivory and are decorated with engravings, or are finely sculptured to resemble some kind of animal. The spear-thrower has not been found among prehistoric remains of a later date, but the "brocket" was used by the ancient Greeks and Romans, and the Vikings seem to have used a similar device.

Daggers are weapons rather of war than of the chase, but in the form of hunting knives may be used to despatch animals at close quarters. Without handles, of which those from the earliest days have perished, it is not always easy to distinguish a dagger from a spear-head. It seems likely that many of the implements of the Chelles and St. Acheul types may have been used as daggers or knives, with which to kill animals as well as

cut up their carcases, and the same might be true of implements of other industries, especially the fine blades from the period of Solutré. A bone dagger, with a decorated handle, was found in a deposit of La Madeleine date at Laugerie Basse. The first undoubted daggers that we possess date only from the Neolithic Age, and these are made of very fine flint work, and in some cases by their form show that they were set in handles. A number have been found in England, chiefly in the east, of the country, but usually without associations. Still they can be relegated with certainty to the Neolithic Age. They are found more commonly in Denmark and in the Baltic region, where their age is better attested, and there they continued in use until well on in the Bronze Age, for some have been found in which handle and blade have both been executed with very expert flaking in flint, yet copying models which were evidently made in bronze. These daggers, however, like those of the subsequent metal ages, were weapons of war rather than of the chase.

Lastly we come to bows and arrows, which have been used over nearly the whole world and are still in use in many parts of it. Bows are of various kinds, known as plain or self-bows, composite bows and cross-bows. Self-bows are made of a single piece of somewhat elastic wood, and strung with a strip of rattan, raw-hide or with cord made from vegetable fibre. They are used in many parts of Africa, some parts of Asia, in Melanesia and in various places in both North and South America. They were used in Europe right up to the Middle Ages, especially in England, whose archers made themselves famous at Créçy. In Europe the bow was generally made of yew, and a very fine example in this wood has recently been found in the moat of Berkhamsted Castle. The composite-bow was usually made of two horns, and

did not develop early, nor was its distribution wide. It was used by the ancient Greeks, the Lycians and the Parthians, and in more recent times some of the North American Indians used a very similar weapon. The cross-bow is believed to be of Asiatic origin and was employed in China, India and other parts of Asia and in some parts of Africa. It was an important weapon of war in Europe during the Middle Ages.

Arrows are often made of several pieces, but the simpler forms consist only of the shaft, made of a reed or slender pieces of wood, the feathers tied or otherwise fixed to the butt end, and the head or point, usually made of stone, wood, bone, ivory, or in later days metal. Arrows without metal heads are still in use in New Guinea, the New Hebrides, the Solomon Islands, and were formerly used in many parts of North and South America, Africa and Asia, as well as in Europe in prehistoric times.

It is claimed by some that bows and arrows were used throughout the Upper Palæolithic Age in Europe, because of the presence of those curious bone implements, sometimes called *batôns-de-commandment*, but more usually arrow-straighteners. It has been pointed out, however, that similar implements are used by the Eskimo for removing the kinks from their raw-hide ropes, whether used for harpoons or for dog-harness. It seems likely, therefore, that the men of Aurignac and La Madeleine used these implements for a similar purpose, and that they may indicate the use of lassos rather than of bows and arrows.

The presence in the La Madeleine layer at Mas d'Azil and Bruniquel of small sharp bone objects has led others to suggest that the bow was in use before the close of the Upper Palæolithic Age in France, but these may well have served as the heads of small javelins.

The earliest reliable evidence comes from a rock-painting at Alpera in Spain, between Madrid and Valencia. Here there are several figures depicted, holding in their hands what are unquestionably bows, from which they are shooting arrows at a number of wild cattle and deer. The Alpera painting is believed to date from near the end of the Upper Palæolithic Age, and is about contemporary with the industry of La Madeleine in France. During the whole of this time there had been a constant movement of people into Spain from North Africa, and it is from this quarter that we must conclude that the bow and arrow were introduced into Europe during the closing phase of the Upper Palæolithic Age, though at that date it was not carried north of the Pyrenees.

After the Palæolithic Age had come to an end, and during the early centuries of the Mesolithic Age, fresh swarms of people came over from North Africa, since the Sahara was then becoming a desert. These people, known to archæologists as the Final Capsians, undoubtedly possessed bows and arrows, and they carried the knowledge of these almost all over Europe, and over many parts of Asia and Africa, for their distinctive culture has been found as far afield as Ceylon and the Cape of Good Hope. These people used a square-ended arrow-head, with a cutting edge rather than a point, and such arrow-heads have been found as far apart as Mugem, near the mouth of the Tagus in Portugal, and in Denmark.

A new type of arrow-head appeared in Egypt with the Badarian culture, and seems to have been brought from somewhere in Asia. These arrow-heads are finely made with two long barbs but no stem. By degrees this type of arrow-head travelled across North Africa and came to be used in Spain and West Europe. In the meantime arrow-heads of various types developed, some

leaf-shaped, some with tangs and no barbs, some with barbs and no tangs and some with both. As the Bronze Age came on another type, larger and of triangular outline with two straight barbs, developed apparently in Ireland, and soon spread elsewhere. Bronze was too valuable a commodity to use for arrow-heads, which were liable to get lost, and so flint was used until iron became plentiful and cheap. A few bronze arrow-heads have been found in Central Europe, and they are not uncommon in Egypt, but elsewhere they are almost unknown. A curious type, with three tangs or blades and an almost triangular section, arose in Asia, but only as iron was coming into use there. They have been found from China to Greece, and even on Greek sites in South Italy, but they are believed to have been made and used by the Scythians. Large numbers of these have been found on the field of the Battle of Marathon, discharged, it is thought, by some of the mercenaries of Darius, some of whose troops, so Herodotus tells us, were still using stone-tipped arrows.

Most other types of piercing weapons, stilettos, dirks, rapiers, axes, knives, swords and guns, belong for the most part to later times, when metal was well known and people had become civilized; these, in so far as they were used as weapons, were employed also for war and not for the chase. We must not, however, close this chapter without a word on harpoons. These are used mostly for hunting aquatic animals, and their distinguishing feature is that the point is detachable from the shaft, to which it is attached by a line. Such harpoons are used by the inhabitants of Tierra del Fuego and various other primitive peoples in South America and Africa, but chiefly by the Eskimo.

Harpoon-heads of bone, not unlike those used by the Eskimo, were made in Europe during the period of

La Madeleine. At first they were simple long narrow and conical points, then they developed a series of barbs along one side, and in the latest phase of the period they had a row of barbs on either side. The use of the harpoon continued during the Mesolithic Age, when various types arose in different parts of Europe. Flat harpoons of red-deer antler were used with the Mas d'Azil culture along the Atlantic sea-board, and have been found from the Pyrenees to Oban on the west coast of Scotland, while a different type, much more slender with a single row of barbs, has been found in Denmark, with the Maglemose culture, and examples of this type have come to light in Holderness, in Yorkshire. Another type, with small flints set as barbs into a bone shaft, has been found in the peat-mosses of Denmark.

Lastly we must say a word about fishing. The use of nets probably goes back to very early times, but the first evidence of such appliances comes from the Swiss pile-dwellings, dating from the Neolithic Age. On the other hand curious bone or antler objects, thought to have been used as some form of fish-hook, have been found at Bruniquel, Fontarnaud and elsewhere in France; these date from the La Madeleine period. Fish-hooks, properly so called, do not appear until we find them in copper first among the predynastic Egyptians and later among the pile-dwellings in Switzerland.

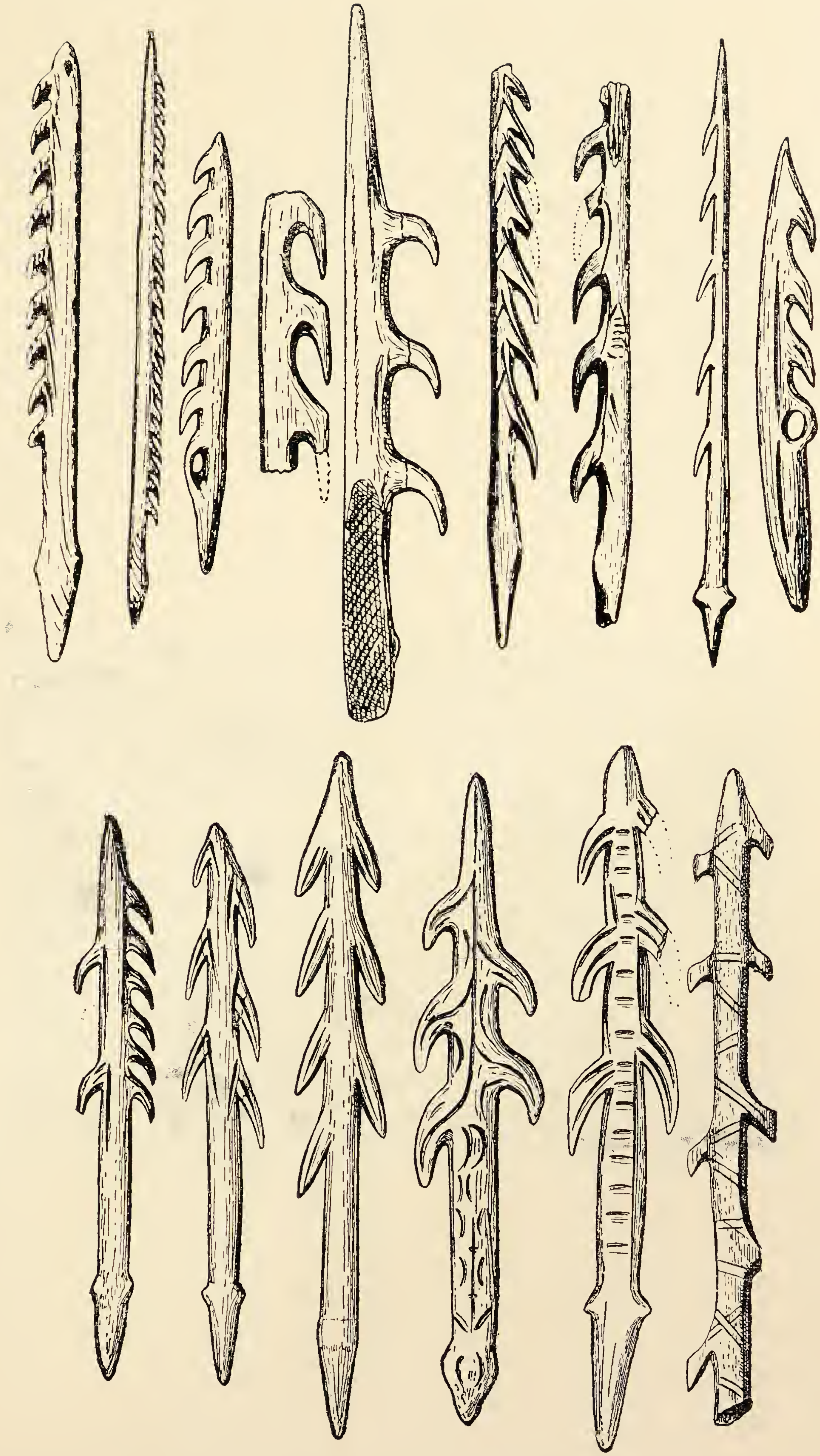

Plate XXIII. Harpoons

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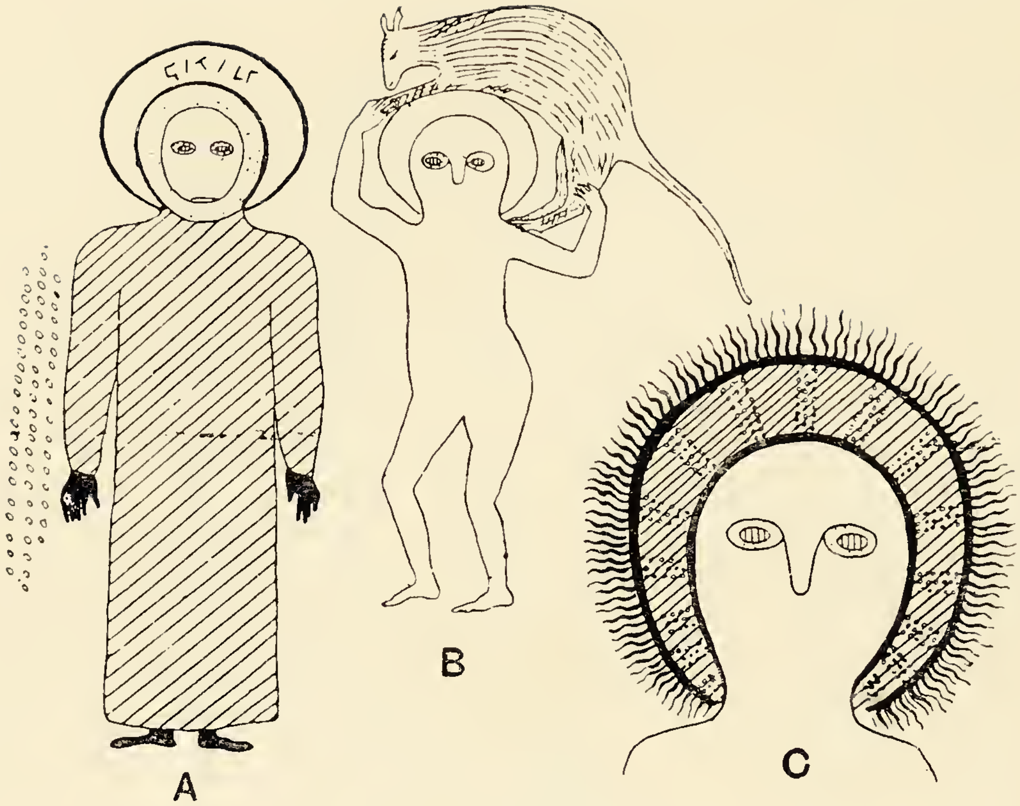

a. Australian paintings

b. Bushman paintings

PLATE XXIV. PAINTINGS BY PRIMITIVE PEOPLES

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CHAPTER VIII

THE BEGINNINGS OF ART

One might imagine, and with good reason, that the graphic arts, drawing, painting and sculpture, arose at a time when civilization was sufficiently advanced to enable some members of the community to obtain a certain amount of leisure and of wealth, and to be possessed of habitations that had risen beyond the humble hovels that for long gave shelter to all mankind. Nor would such an idea be altogether incorrect, though it is by no means completely true. It must be remembered that works of art, often elaborate in nature and not without considerable artistic value, are to be found among many primitive peoples, and these are more noticeable among the lowest hunting tribes. Other works of art, still more amazing, date from the Old Stone Age, when man also depended for his subsistence upon the products of the chase. What is the meaning of this apparent anomaly?

The hunter's life is by no means easy and the search for game is an arduous task, involving long wanderings and many days of privation, when the hunter is well-nigh starving. Sooner or later, if the hunters survive the perils of the chase, the quarry is killed, and its slayers have meat in abundance. At first they gorge themselves and sleep long hours in order to recover, then they continue their meal, not disdaining game far more high than would suit the taste of a fashionable gourmet. Still, especially in hot countries, the meat has passed

beyond the stage of food before it is all consumed, and in due course the hunters resume the chase. In the interval, however, while there is still meat to be had, the party has leisure and, having no other occupation, frequently devotes much of its time to the production of works of art. Such works, drawn and painted on rock surfaces, were, until recently, produced by the Bushmen of South Africa, while others, not quite their equal in artistic value, are still made by some of the Australians.

The men of the Old Stone Age had an advantage over the Australians and the Bushmen. They lived, or many of them did so, in Europe during the Ice Age, and, while they hunted on the dry grassy steppes in the summer months, during the arctic winters they retired to caves, in which they could live in comparative comfort during the inclement weather. The game killed in the autumn could thus be placed in a natural cold storage, and, if the autumnal forays had been successful, the larder would be full enough to enable them to spend the winter with almost complete leisure. Thus it is that the art of the cave men of the Upper Palæolithic Age excels that of any of the recent or existing hunting tribes.

We have no knowledge of the art of our earliest ancestors, for their remains have been found only in gravel deposits, in which objects of art, had they existed, must necessarily have been destroyed. We can tell nothing, therefore, of the artistic proclivities of the men of the Eolithic or of the Lower Palæolithic periods, for those curiously chipped flints, resembling faces of men and animals, sometimes called "figure stones," are but flint pebbles that have become chipped by natural forces until they bear some slight resemblance to natural objects, and their ascription to human agency is but the vain imagining of over-speculative antiquaries.

When we come to the Middle Palæolithic period the

case is different, for the men of Le Moustier, the Neanderthal men, spent the long cold winter days and nights of the Würm glaciation in the fastnesses of the limestone caves. There is no reason, therefore, why Neanderthal man should not have spent some of his leisure hours in decorating his subterranean abode. In spite of this, no remains of drawing or sculpture have been found that can with certainty be attributed to this period.

It is with modern man, *Homo sapiens*, that art first appears in Europe, nor have we any indications of its presence elsewhere until his arrival. It would appear that the desire to represent human and animal forms and to decorate his surroundings is a peculiarity of our species and was not shared by his forerunners. Art, it would seem, is the prerogative of modern man.

Cave art is of two kinds, fixed and movable. The examples of fixed art are mural decorations, either engravings or paintings, on the walls of caves or rock shelters, or sometimes, expecially in Spain, on an exposed face of rock. Except in the case of the Spanish rock paintings they are always of animals, the human form being never depicted save in one case, in a cave in the Pyrenees, where there is a picture of a man disguised as an animal. Movable decorated objects are usually bone implements, such as knives with ornamented handles, but may be also engravings on small slabs of stone; there are also a few human figurines in the round.

The best known examples of cave art come from the south-western corner of France, mainly from the Dordogne and the Pyrenees. In the earlier phases of the period of Aurignac we find chiefly rows of dots, spiral tracings and silhouettes of hands, the last-named being formed by dipping the hand in some pigment and then laying it on the wall of the cave, or else by laying the

hand upon the wall and squirting paint around it. Then we find simple pictures of animals, traced with the finger upon the wet clay, adhering to the sides of the caves. After these come pictures, deeply engraved, and a few animal figures in outline, painted with red or black pigment. In the last phase of this period the drawing is better and the engraved outlines have a more realistic appearance. The painted pictures also improve, for the modelling of the figure is frequently emphasised by shaded colour or by a series of lines or dots.

It was at one time believed that no works of art had come down from the period of Solutré, but a few have been discovered recently, though it is believed that these were the work of survivors from the earlier period. After the departure of the men of Solutré, the descendants of the earlier artists returned to the French caves and continued their artistic efforts during the period of La Madeleine. Soon after this the engravings on the cave walls reached their highest pitch of perfection, then the drawing became executed in a careless manner, and by the close of the period the style had degenerated considerably. The figures represented in the French caves at this time were always those of animals, usually single figures, though these are frequently found one superimposed upon another, from which it is possible to distinguish their relative age.

Decorated chattels of this time are of various kinds. Some are carvings in the round, some in high or in low relief, while others are engravings in outline, occasionally with, more often without, shading; the material used is stone, bone or ivory. The decorated bone objects are usually those in daily use, such as knife handles or those curious implements known as arrow-straighteners or *batôns-de-commandment.* These are usually ornamented

a. Silhouettes of hands

b: Stag and deer

c. Woolly rhinoceros

PLATE XXV. AURIGNACIAN PAINTINGS

Plate XXVI. East Spanish Art

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with figures of men or animals, often very realistically portrayed, though somewhat conventional towards the close of the period. The representations of the human figure come mostly from the period of Aurignac, and during the earlier phases of this period they are usually in the round; other figures in the round from Central Europe are attributed to the period of Solutré, though we may suspect that the artists were men of Aurignac. These figures are almost all of women, usually very fat. One group of representations is quite unlike all others, for in this case the figures, which represent bison, were modelled in clay. These were found in the cave of Tuc d'Audoubert, and are believed to date from the period of La Madeleine.

While the description given above is true of the Upper Palæolithic art of France, and, to some extent, of Central Europe, a very different kind of art was in vogue in Eastern Spain. Here the pictures are of very small dimensions and are found painted upon the face of the rock, in shelters or quite in the open. These pictures, which are in a much more vigorous style than those of the French caves, show groups of animals and human beings, and usually represent hunting scenes. These bear a very close resemblance to a number found in Rhodesia and elsewhere in South Africa, the latest of which are attributed to the Bushmen.

There has been much discussion as to the motives that led our early ancestors to spend so much of their time in these artistic efforts. Some have thought that the long imprisonment in the caves during the arctic winters of the Ice Age made time hang heavily on the hands of the hunters and that by decorating the caves they found something for idle hands to do. Others believe that the beautification of their caves was the chief purpose, though one drawing is often, as we have seen,

superimposed on another, often on a number of others, while many of the best works of art have been executed on the roofs of caves, into which no ray of daylight has ever penetrated, or on the walls of narrow passages where they can only be seen with difficulty. Others have invoked the desire of "self-expression" to account for the pictures.

The majority, however, believe that these drawings had a magical significance, that the picture of a beast was made to insure that such beasts should be plentiful, and the fact that the animals represented are almost always those hunted for food suggests that this is the true explanation. This view is supported by the fact that some engravings depict a beast struck by an implement in a vital part. The hunting scenes in East Spain would then express a desire for "good hunting," and the figures of fat women may perhaps signify a desire for more children.

At the close of the Upper Palæolithic Age the art shows signs of degeneration. The Ice Age was passing away and the winter holiday was becoming curtailed, so the drawings had to be more hurriedly done. When this age was over, and the forest had spread over nearly the whole of Europe, and the Ice Age had finally passed away, we find in the succeeding Mesolithic Age that complete degeneration had set in, and that the once realistic figures of men and animals had become conventionalised into a series of signs, the origin and meanings of which would have been unintelligible did we not possess a series exhibiting their gradual descent. Thus, under the stress of hardship during the Mesolithic Age, the fine art of the Upper Palæolithic Age gradually degenerated into apparently meaningless symbols, until it disappeared altogether.

In Spain, however, owing to the dry climate, the

forest failed to cover the greater part of the peninsula. Here the East Spanish art survived much later, and, though in time, as the arctic winters disappeared, it lost much of its pristine vigour, it nevertheless survived, especially in the southern provinces, even after the knowledge of metal had been brought from the Near East to the uttermost parts of the West. From Spain this late form of art spread, and with it the knowledge of copper, along the Mediterranean coast of France as far as the borders of Italy, and in the mountains on either side of the frontier have been found a number of rock engravings of men armed with tools and weapons of copper, which are clearly derived from similar drawings that are found in abundance in the southern provinces of the peninsula.

Elsewhere, as we have seen, artistic efforts gradually ceased during the Mesolithic Age, for the wretched inhabitants of Europe were compelled to hunt all day and every day for sufficient shell-fish and small game to keep them from starvation. After agriculture had been introduced man had to earn his bread by the sweat of his brow, for the early types of grain that he grew were small and not over nutritious, while to cultivate the soil with the sole aid of a stone hoe was a laborious undertaking. Small wonder, therefore, that the men found no time to produce works of art. The only examples of such works found in Europe, that date from the early days of agriculture, are small figurines of a female, believed to be the Great Mother, the goddess of fertility, the deity that presided over the crops. It is true that the women, who were the potters, decorated their wares, in some cases most elaborately. This, however, is a subject that must be discussed in a later chapter, when dealing with the potter's craft.

There was one country, however, though outside of Europe, in which works of art were produced during the

early days of agriculture, and this was Egypt. By the banks of the Nile the soil was easily manipulated and on the alluvium it was rich and became renewed each year as the Nile floods subsided. Here again crops were possible in greater profusion and with less effort than elsewhere, while fish and certain edible weeds could be obtained from the river. It is not surprising, therefore, that we find works of art more abundantly here than among other early agricultural communities.

The early people living in the Nile Valley, known to archæologists as Badarians, occasionally carved small representations of the human figure out of bone, and their successors, in the predynastic period, made rude figures of animals out of bone and stone, and decorated, often with considerable taste, the slate palettes on which they ground lumps of malachite for painting their eyes.

Such representations of human and animal figures are, however, rare among early agricultural peoples, who seem to have had too little time to devote to art, except to decorate their pottery. Such decoration is usually of a formal or conventional kind, often of geometric patterns, though naturalistic designs occur fairly early in the Ægean Islands, and figures of birds and animals, and even of human beings, are not altogether unknown in the Near East. The subject of pottery and its decoration must, however, be left to a later chapter.

With the exception of the few cases of art and decoration described in the preceding paragraphs, we find little evidence of the development of art until people were living in prosperous communities, engaged in trade and under a settled government. Under these conditions some of the people, and especially the ruling classes, accumulated considerable wealth and had a corresponding amount of leisure. Then we find a considerable development of the arts of architecture and

sculpture, especially in Egypt and Mesopotamia. This new development of art was largely in connection with temples and tombs, and in Egypt it is not easy to draw a distinction between the two, so that art continued, as it had begun, to be closely related to religion, a relationship that has subsisted, sometimes to a greater and at others to a lesser extent, until our own day.

CHAPTER IX

BASKETS AND LEATHER BAGS

WHILE man was still in the hunting stage he was constantly on the move and had to travel light; he was unable, therefore, to carry about with him anything that was heavy or liable to be broken. Nevertheless it was convenient and sometimes necessary to take a small supply of water, while his women-folk probably needed some receptacles in which to store nuts and berries, as well as other small commodities that could supplement the meat diet on which they depended, or on which they could fall back if the chase had proved abortive.

Those who had passed from the condition of hunters to that of food-collectors as the Mesolithic Age advanced, needed more of these receptacles and probably a greater variety, for their food consisted mainly of a number of small items laboriously collected in the neighbourhood of a settled home. The fixity of the home, which now became the rule rather than the exception among these hungry folk, enabled them to possess a larger number of such receptacles, which could now be heavier and more fragile. It is, then, especially to the Mesolithic Age and the life of the food-collectors that we must attribute the first use of many of these simple contrivances, which preceded the use of pottery.

Owing to the perishable nature of the materials used, few, if any, of these receptacles of early days have come down; to us in fact, it is doubtful whether any such have been found that can be considered as belonging to

a period prior to the introduction of agriculture. Nevertheless we can form some idea of their nature and form, for many such articles are made and used to-day by primitive peoples, many of whom have not yet learned the art of growing grain, and much of the earliest pottery known was clearly made in the form of receptacles of other materials, which we may reasonably suppose to have been in use before the potter's art was known.

The first class of vessels that we must deal with are natural objects capable of holding water or other supplies, and which are or have been used for such purposes. Among these are gourds, coconuts, pieces of bamboo stem, shells of molluscs, horns of oxen and the shells of ostrich eggs.

Gourd-bearing plants are found growing in most of the warmer parts of the world, and have been frequently used for holding liquids, and are still so used in many places. When it is desired to produce a bottle-shaped vessel, this is achieved by tying a cord round the growing fruit. When the gourd is dry, all that is necessary is to cut off one end and scoop out the contents through the hole thus made. Gourds are extensively used as vessels in some parts of Southern Europe, over most parts of Southern Asia, in Africa, in the islands of the Pacific and in the warmer parts of America. They are frequently decorated with incised designs, sometimes enclosed in a network of string or rushes, and in Japan they were until quite recently used for carrying about a supply of *saki*, the rice spirit of that country.

In several regions there have been found pottery vessels, of very early date, which appear to have been formed on the models of gourds. This is specially true of Asia Minor, the Danube basin and Cyprus. In the last mentioned island some of these gourd-shaped pots are decorated with a lattice design, exactly similar

to the network of rushes used elsewhere to enable the gourd to be carried with a handle. From the constant occurrence of such gourd-like forms in the earliest pottery found, especially in South-east Europe and South-west Asia, we must conclude that at a still earlier date, when men were living in a Mesolithic condition, ignorant alike of agriculture and pottery, they had been in the habit of using gourds, often covered with a network of rushes, for storing and carrying water.

Coconuts are used to hold water in Africa, in some parts of Southern Asia and in the Pacific Islands; they are sometimes enclosed in a network of fibre, as is usual in the Fiji Islands. The surface is sometimes decorated with incised designs, and is inlaid with pieces of mother-of-pearl in the Solomon Islands. Small lengths of bamboo stem, cut so as to leave one or more joints, one of which forms the bottom of the vessel, are used for carrying water in some parts of Eastern Asia and the Pacific Islands. Such vessels are still used as hanging flower vases by the Japanese.

Shells of molluscs are occasionally used in New Guinea, while the Nautilus shell is used as a drinking cup in the Andaman Islands. The horns of oxen are used as drinking cups by the Zulus and other African tribes, and were utilised for a like purpose by our Saxon ancestors. The shells of the ostrich have been used by some of the native tribes in South Africa, especially the Bechuanas, and in some places the shell of a land tortoise has been used to hold food and water. Since, however, we have found no early pottery that can be considered as derived from any of these forms, we have no reason for believing that they were used by early man.

The true hunters were mainly employed in killing beasts, and after they had eaten the flesh the skins remained over. These they used for clothing, for rugs

and for covering their simple tents, but a considerable quantity must have been left over, and it is reasonable to suppose that most of this was converted into bags or other receptacles for food and water. What is true of the hunters would have held good equally for the herders of cattle, sheep and goats on the grassy steppes and mountain sides. Leather, however, perishes as easily as gourds, and so we have not found any such skin receptacles among the remains of early man. There are, however, people still in the hunting stage to-day, and some of these use receptacles made of skin for various purposes.

The natives of Australia are still in the hunting stage, and many of these use skin bags for carrying water over long distances. These bags are made from the skins of kangaroos, opossums or other animals, by cutting off the head and removing the skin by turning it inside out, as one may take off a glove or a stocking, thus leaving as few holes as possible. The inside of the skin is tanned with bloodwood gum, and then reversed again. The openings at the tail, legs and elsewhere are closed by means of bones or wooden pegs, and tied round with tendons. Then the two hind legs are tied together to act as a strap, which can either be slung on the shoulders or used as a handle. The water-sellers in Egypt and elsewhere in North Africa carry an almost similar bag of goat-skin. Skin vessels are used by the North American Indians and the Eskimo, and skin bottles or wine-bags are known from Spain, Siberia, India and other places. Leather bottles and "black-jacks" were in use in this country until a few centuries ago.

We can well believe that such leather bags and receptacles were used by our hunting predecessors, and, in fact, the presence of the water skin, made in an almost identical way, in such distant places as North Africa

and Australia, suggests that this is a very old contrivance, and was used by the earliest of modern men before they had entered either Europe or Australia. From the nature of the case, however, we are unable to produce any positive proof. We can, however, as in the case of gourds, produce some evidence that the smaller skin bags or cups were used in Mesolithic, if not in Palæolithic, times, from the forms of pottery found in the earliest agricultural settlements. There are many examples of these, but it will be sufficient to cite the three most obvious cases.

It will be remembered that the earliest post-Mesolithic culture found in Egypt is that known as the Tasian, and among the remains of this civilization the most conspicuous items are the small pots or cups, which were at first believed to belong to the Badarian civilization, and are sometimes described as such. These pots or beakers are of a dark brown ware, and have been described as tulip-shaped, though their form is more like an upturned bell. They are decorated with incised or impressed lines of geometric decoration. In another civilization, nearly three thousand years later, which is found chiefly in Eastern France and Western Germany, pots or beakers of a similar form have been found. These belong to a civilization, known from the site at which it was first discovered as the Michelsberg culture, and it flourished about 2300 B.C. on either side of the Rhine, and spread northwards as far as Belgium and Holland. Since these two cultures are so widely separated in time and space, there can hardly be any direct connection between them, for the Tasian beakers ceased to be made when the Badarian civilization entered Egypt, while the Michelsberg culture is one of the earliest in Western Europe in which pottery was used; no other pots of similar form have been found from the intervening areas or dating from an intermediate time.

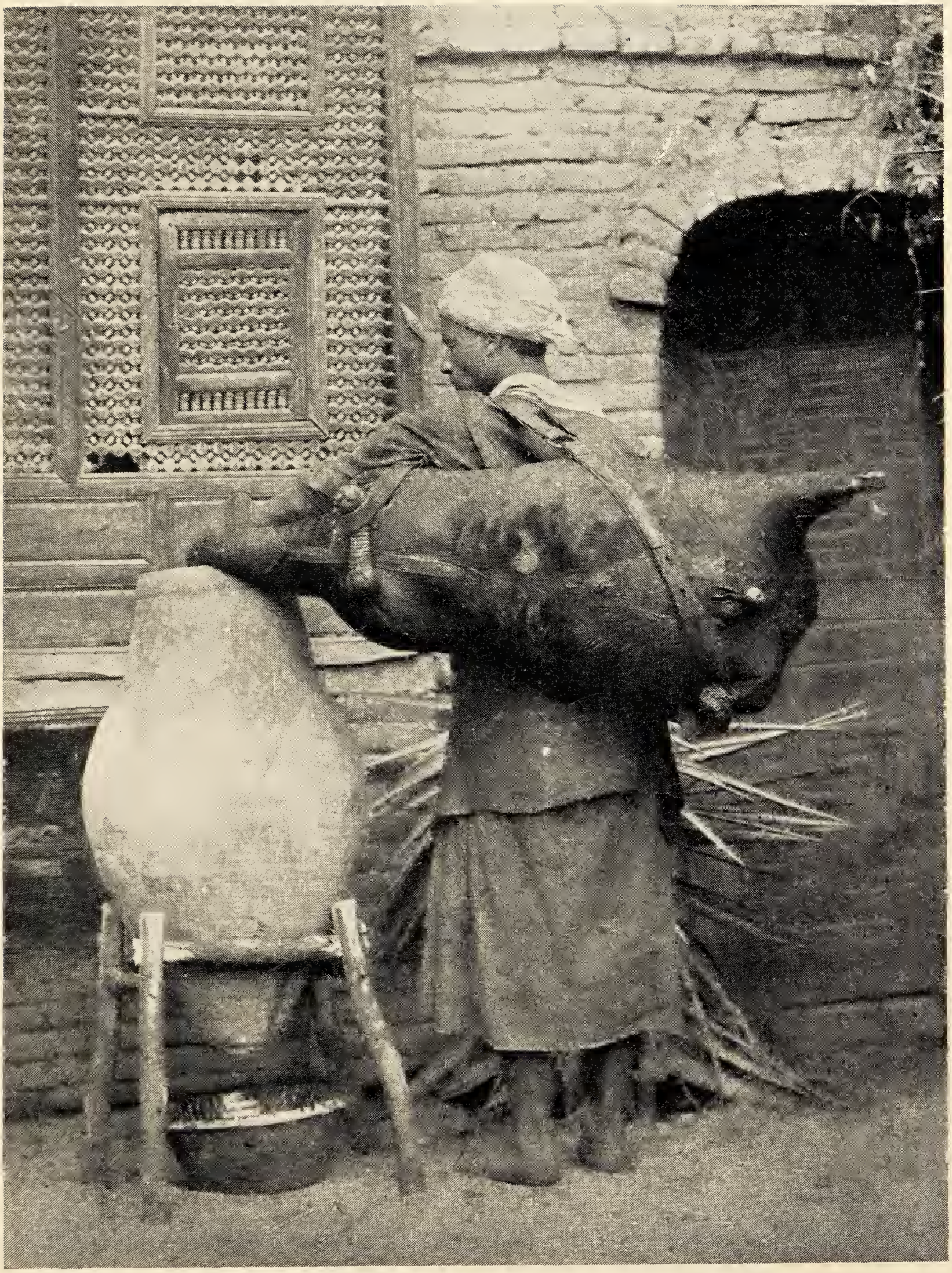

Photo: E.N.A.

PLATE XXVII. WATER-CARRIER IN CAIRO

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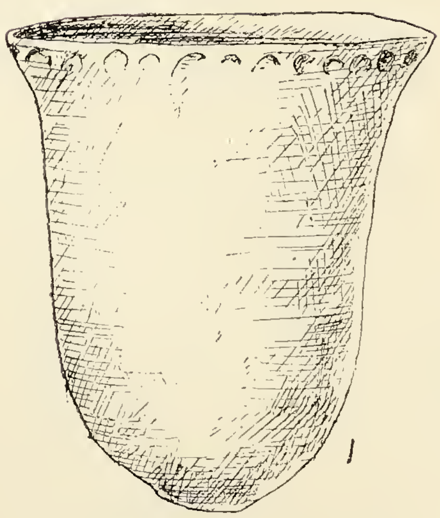
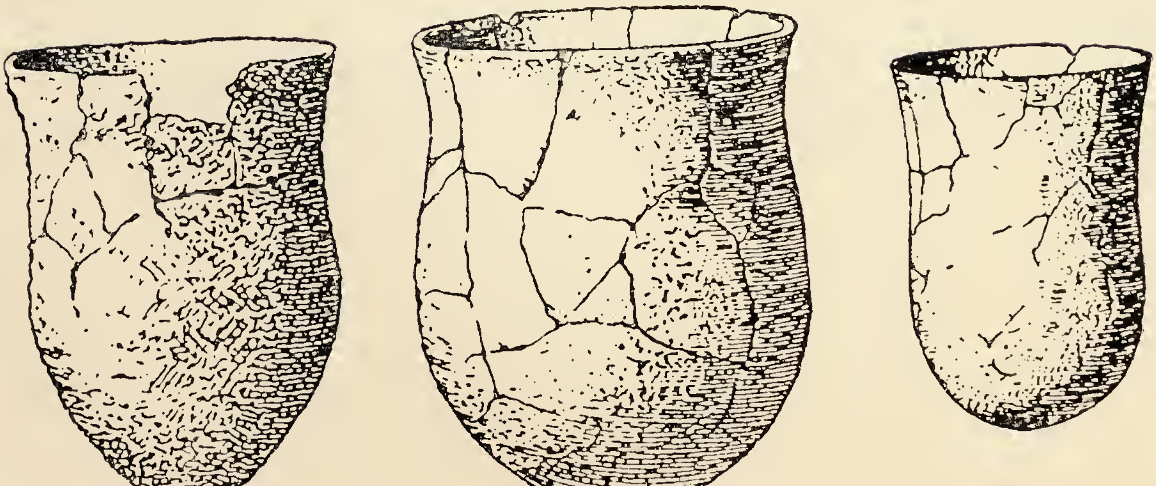
a. Tasian beaker



b. Michelsberg beaker



c. Bag-shaped pots from Michelsberg

PLATE XXVIII. POTTERY MADE ON A LEATHER MODEL

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Though there may have been no direct connection there may have been one more indirect. If the inhabitants of North Africa to the west of Egypt, who lived during the intervening time in a Mesolithic condition, and the people of Western Europe, who were not further advanced, had used a cup of this shape but of some other material, we could understand how both forms became translated into pottery when the potter's art became known. This seems to be the most likely explanation. It has been suggested that the Tasian beaker was derived from a basket-work original, but it seems more likely that this and the Michelsberg beaker, too, were derived from small skin bags, used as drinking-cups, and which had a wide distribution throughout North Africa and elsewhere in the Mesolithic Age, and were carried by the Final Capsians to Europe and to those other regions to which they took their microlithic flints. The geometric designs on the Tasian beakers seem to be imitated from the impressions left on the surface of the skin cup by a binding of sinew, placed there to preserve the shape of the beaker.

Another type of early pot, found over many parts of Western Europe, sometimes with the Michelsberg culture, yet having a wider distribution, is a bag-shaped pot, nine or ten inches high and six or seven in diameter. These look like bags, the greatest width of which is about a third of the way up from the bottom. These, some of which have been found in the Neolithic village at Windmill Hill, near Avebury, in Wiltshire, are clearly derived from a leather original. A variant of these is hemispherical, as though the lower part only of the original bag had been retained. The rim looks like the opening of a bag in which the edge had been turned over to the inside, while they are usually furnished with a pair of pierced lugs, either horizontal or vertical, which

seem to represent places where the original leather had been pinched up and perforated with a wooden skewer.

Such beakers and bags, if they were used by the Mesolithic folk, must have been tanned or otherwise prepared, and then filled with sand and allowed to dry in the sun, if it was desired to preserve their form, an object that would be better assured if they were laced round with strings of sinew, as seems to have been done in the case of the models for the Tasian beakers. If, however, the bag were only half filled with sand, the lower part would dry hard, but the upper half would remain soft. Thus one would have a bag, with a more or less rigid hemispherical base and a soft upper part, which would tend to contract, especially if leather strings were attached to it for carrying. Pots resembling bags, such as have just been described, have been found in Bohemia, where they are called "stroke-ornamented ware," because they are covered with incised ornament, which suggests that the original leather bags had been decorated with a simple stitching with narrow strips of skin. Pots of this form, with a hemispherical or convex base, and a concave upper portion, leaving a kind of keel between the two parts, have been called carinated, and have been found frequently with early civilizations, not only in Bohemia, but also throughout the whole of the Atlantic sea-board from North Africa and Spain and the Isle of Arran.

Various other types of pottery could be cited, showing a derivation from leather originals, sometimes due to the form and at others to the decoration. Dr. H. Frankfort has maintained that certain tumbler-shaped cups, found in graves of the earliest period at Susa in Persia, which are decorated with triangular designs, are due to a *motif* that began with applied leather-work, while the

distinctive decoration on some of the modern Kabyle pots from Algeria is thought to be derived from an embroidered decoration on skin.

To return to the receptacles used by primitive peoples, we must not omit to mention the bark vessels made by the Australian aborigines; these are made in a more elaborate and highly-finished manner by many of the North American Indians. Various utensils of birch bark are used by the Gilyaks and other wandering tribes in Northern Asia, while a bark tray is used for fish by the Ainu of the northern island of Japan. The now extinct Tasmanians made bags or buckets of seaweed, while a vessel for holding water is made out of a palm leaf in New Guinea.

Carved vessels of wood, usually made of one piece, are used in Africa and in the Pacific Islands, and are known to occur in some parts of Asia, in North America and elsewhere. Such vessels and utensils are to this day used in Norway, and wooden bowls for soap are still made for sale, on a primitive lathe, on Bucklebury Common, in Berkshire.

Vessels made of stone are rarely used except as mortars for bruising corn, but cooking vessels of soapstone were made by some of the North American Indians and by the Eskimo. The Haida of Queen Charlotte's Island, off the coast of British Columbia, made most elaborate stone dishes, often elaborately carved. Stone bowls were made in Egypt in predynastic times, and at least one vessel of this material was made by the Badarians. It was shaped like a top hat, and when found was full of grain. It is unlikely that stone vessels were used before agriculture was introduced, for such articles would have been too heavy for hunting man to carry with him on his wanderings, and the food-collectors of the Mesolithic Age were too busy gathering their

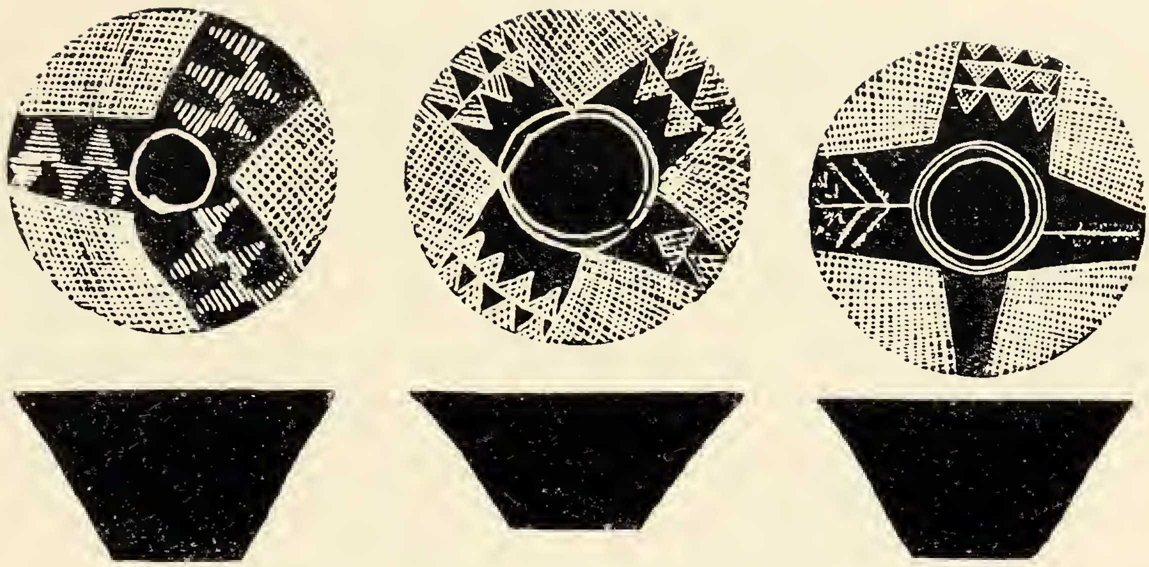
meagre supplies of food to be able to spare the time for so elaborate an undertaking.

Another very important series of receptacles, made in great numbers by primitive peoples to-day, is baskets. They are made and used by all sorts of people, savage and civilized alike, and are constructed of various materials, flexible roots, stems, leaves of plants or portions of them. There are two principal ways in which baskets are made. In one the various materials are used in much the same way as in weaving material or mats, and these are called woven baskets. In the other case the heavier material is wound in a spiral coil, the turns of the spiral being sewn together by a lighter material; these are called coiled or sewn baskets.

Many different types of woven baskets are recognised, such as "wickerwork," "wrapped-work," "twined-work," or "fitched-work," "chequer-work" and "twilled-work," but the details of these need not detain us here. Woven baskets of one or more of these kinds are made in nearly every country in the world.

Coiled baskets have a more limited range. The best examples are made in Africa, especially in the East, among the Somali, the Barotse, and in the Sudan. A great number are made in North America, especially in California, but they are also used in Australia, China and elsewhere. Baskets of both types are sometimes so closely woven that they will hold water.

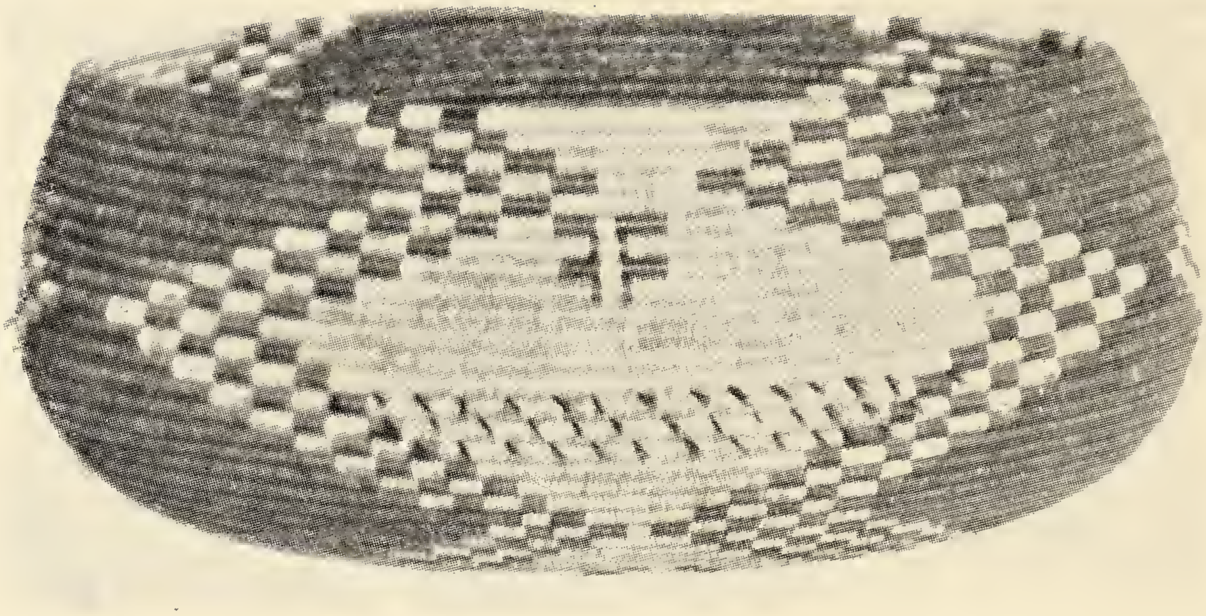
That men in the Mesolithic Age used baskets is abundantly clear from the fact that many types of pottery are evidently derived from them. The designs on several bowls from the first civilization at Susa are very similar to those on some baskets from America, two types of pottery found in early predynastic graves in Egypt, the "White-lined" and the "Black-incised," seem to be copies of bowls of basket work made of fine



White cross-line ware from Egypt

Black incised ware from Egypt

Plate XXIX. Pottery Made in Imitation of Basket Work



a. Pomo three-rod coiled basket

b. Attu woman weaving a basket

PLATE XXX. WOVEN AND COILED BASKETS

grasses, and the same is still more obvious in the decoration on some of the earliest pots found in the Cycladic islands in the Ægean Sea.

These instances could be multiplied indefinitely, but since some of the earliest pottery known has been decorated in imitation of basket work, it is clear that baskets had been made and carried to a high pitch of perfection before the potter's art was known. Since, too, pottery seems to begin in most parts of the world at the close of the Mesolithic Age, we must credit our food-collecting predecessors with a knowledge of how to make woven baskets of elaborate form and often with a considerable amount of ornament.

How the art of weaving arose is uncertain. The weaving of baskets in its simplest form is closely allied to the construction of wattle-work in primitive dwellings. As we shall see in a later chapter, there is good reason for believing that the earliest wattled huts must go back at any rate to Mesolithic times; but which came first, the basket or the wattled hut, we have at present no means of determining.

CHAPTER X

HOW ANIMALS WERE TAMED

In a previous chapter we saw that as the last great Ice Age was passing away, during the period known as the Bühl stage, forests began to creep over the hitherto open land of Europe. First came the pine forest, entering Europe to the south of the Caspian Sea, and then by degrees covering the whole of Europe, except dry areas of limestone and drifting sand, until it reached Britain, still part of the continent, and the Scandinavian lands. Eastward these pines spread across North Russia and on into Siberia until they met another type of pine forest coming from the East. This forest seems also to have spread southwards into Syria, Palestine and North Africa. The pine forest was followed by an oak forest, which reached as far as the Lowlands of Scotland and parts of Finland, but did not spread into North Russia. This again was followed in some places by a beech forest, which did not, however, extend farther north than Denmark, or eastward beyond the Russian border.

This invasion of woodland, into what had been the grassy plains of Europe, caused all the hoofed animals, that fed on grass, to migrate to lands still open, or to perish. These open lands were parts of the Plain of Hungary, a narrow strip north of the Carpathians in Galicia, and the Ukraine; but the only really extensive grassland or steppe was in South Russia, east of the Dnieper, and this extended into Asia, right across the Plain of Turkistan as

far as the slopes of the Hindu Kush mountains. Northward there were still open lands extending down the Obi valley as far as the Arctic Ocean, only broken in places by belts of pine woods. Eastward from this a further stretch of steppe-land extended north of the mountains to the Pacific Ocean, and across Chinese Turkistan and the Gobi Desert into North China. Over all these areas the rainfall was not sufficient to allow trees to grow abundantly except along the margins of the rivers. In Russia, north of the steppe, there was a broad belt between the true grasslands and the oak forest, and in this trees grew in more favoured spots. This belt is known as parkland, and varied from grasslands dotted with clumps of trees to woodlands with many open glades.

Into this great area of grassland and parkland all the surviving hoofed animals from Europe collected, and here, too, collected many of the men who had lived by hunting them. Others, less adventurous and hardy, stayed behind, settled by the sea shore or by the banks of lakes or rivers. These eked out a miserable existence on fish, shell-fish, roots and berries throughout the long period known to us as the Mesolithic Age.

We must turn, however, to the hunters who had gone to the East, for they are the heroes of this chapter. These were an active, virile crowd, mostly, we believe, descendants of those men who had invaded Western Europe at the close of the Aurignac period, and had introduced the industry of Solutré. The beasts they hunted were varied, but the most important were the bison and the great ox, sometimes known as the aurochs, a large beast with widespreading horns. The bison roamed only on the grassland and was more at home in the colder regions; it was to be found more abundantly in the northern part of the steppe region, mainly in what is now Siberia. The aurochs, on the other hand, was inclined to prefer rather milder

regions, and found it necessary to live, for part of the year at any rate, in the parklands. The cause of this preference was the nature of the new-born calf. Most of the animals of the grassland are born with their feet or hooves fully formed and ready, immediately after birth, to accompany the herd in its wanderings; this is particularly true of the horse. Among cattle, however, the calf is born with hooves of such a form that it can scarcely stand, still less run, for a short time after birth. Since, however, the cattle usually wintered in the parklands, where they could feed on the young shoots of trees and bushes when the snow covered the grass, their young could be born and concealed in thickets until they were ready to wander with their parents.

Such were the conditions of the country and of the beasts that inhabited it when the hunting men went east before the advancing forest, and it seems almost certain that it was these men who ultimately first domesticated cattle and after a further lapse of time tamed the horse and probably the camel too.

We have no direct evidence as to the fortunes of these people after they left Western Europe at the beginning of the last or La Madeleine phase of the Upper Palæolithic Age until a much later date when we find them burying their dead under large mounds or *kurgans* on the Russian Steppe. What happened in the interval we can only conjecture, but we can guess with some degree of probability from the customs practised at a much later date by another people in a very distant part of the world.

When Europeans first visited the prairies of North America they found these extensive grasslands peopled by various tribes of Red Indians, who lived by hunting the bison. Their method of hunting has been described by several of these early observers. A large band of Redskins were accustomed to follow the herds of bison from

one end of the prairies to the other, keeping them constantly on the move. They were usually unable to reach the herd, for they had not then become possessed of horses, and, while they were following their quarry on foot, the beasts were able to keep at a sufficient distance to avoid capture or slaughter. Sometimes, however, one of the bison, ill or weary, fell behind the band, which could not afford to wait for stragglers, and such a laggard fell a victim to the pursuers. In such a way the Redskins were enabled to provide themselves with an adequate if not an ample supply of food, but the method involved a strenuous life for both hunter and hunted, for none but the strongest and fleetest could survive. Thus, by a process of natural selection, both men and beasts became inured to this strenuous life, and both learned to form part of well-disciplined bands and to live and work in harmony.

We must imagine that the hunters on the Eurasian steppes were leading a life very similar to that of the Redskins barely a century ago. Some hunted bison in the northern and colder regions; others the aurochs or wild cattle in the parklands and grasslands of South Russia and Turkistan.

Both in the Old World and the New the bison has resisted all attempts at domestication. He is the stronger animal of the two and seems also to have the advantage inasmuch as his calves are more mobile immediately after birth. We must imagine, however, that the inhabitants of the Russo-Turkistan steppe were mainly engaged in hunting wild cattle, who, in the spring at any rate, would travel at a much slower rate. It would have been possible, therefore, in the early months of the year for the hunters to exterminate their prey had they desired to do so. These men were wise enough and had sufficient foresight to realise that the extermination of these bands of cattle would leave them without any source of food in the

future, and they had been accustomed to kill, not for killing's sake, but to supply their daily or weekly needs. The slaughter of a large number of cattle at one time was obviously a wasteful proceeding, and this was early realised; what was important was to insure that beasts could be slaughtered at any time that they were required for food.

We have seen that on the prairies the Redskins followed the bison without intermission, never leaving any long space between the hunters and their prey. The hunters on the Eurasiatic steppe, we imagine, followed a similar course, but kept the interval shorter, and in course of time contrived to hold the band of cattle during the night, while they camped, by surrounding them or lighting fires around them. Thus for a long time the human and animal bands wandered over the grasslands and parklands in this intimate association, and the beasts came gradually under a certain amount of control and to some extent became domesticated.

We may imagine, too, that sometimes a woman, with an infant to support, may have taken advantage of a cow that had recently calved, and persuaded the beast to share its supply of milk between the bovine and human infants. How such a custom arose we know not, but it certainly occurred in the parklands, in which, as we have seen, the calves were usually born, though it may also, as we shall see, have occurred elsewhere.

The food of these strenuous hunters of the steppe-lands was mainly beef, varied occasionally by venison or other game when such could be found. Milk, though it may in time have been available for the infants, formed, in the first instance at any rate, an unimportant part of their diet, and, though they may have made a little butter, it is unlikely that they had discovered how to make cheese.

Wild cattle lived elsewhere than in the parklands of South Russia. South of the steppe there are mountains,

the Caucasus, the Elburz and the Kopet Dagh ranges, among the foothills of which are woods, thin and open at the bottom, though growing denser as one proceeds up the valleys. Similar conditions are to be found on the slopes of the Hindu Kush at the eastern end of the steppe. Here, as well as in the parklands, cattle could find suitable shelter during the winter, when the grasslands were covered with a mantle of snow, and here their calves could be born under favourable conditions. Broad-headed men of the Alpine race came early to these valleys, spreading along the foothills from the edges of the Armenian highlands that had been their first home. What these early Alpines depended on for food we are not sure, probably on fish from the highland streams and small birds snared at the outskirts of the woodlands. They were, we may feel sure, living a precarious life with a very uncertain supply of food, and we may well believe that hunger often stared them in the face.

Some of these valleys, as we have seen, ran down to the grassy plains, over which the wild cattle roamed in the summer and autumn, and it is likely enough that on their wooded slopes some cows took refuge as the time of calving approached. Here, it seems likely, the cows were occasionally tended and fed by the Alpine women, and in such valleys arose, it would seem, the practice of dairying, with its products of milk, butter and cheese. It is, at any rate, among such valleys and such people, both east and west of this area, that we find the practice of dairy-work established at a very early date, and even to-day the dairy farm is the chief industry in the mountain regions of Europe and Asia. This practice was not confined to the northern slopes of the Armenian mountains, but soon became common on the southern side, and thence spread into the valleys of the Tigris and Euphrates, where we find it established at a very early date. A limestone frieze,

that was found a few years ago at Ur, shows us a scene in which a number of cows are being milked, not from the side as is now the usual custom, but from behind between the hind legs.

While bands of wild cattle were being gradually brought under control on the steppes, and stray cows domesticated in the mountain valleys, other men were making similar experiments elsewhere. Somewhere in the mountains sheep were being tamed and goats also, but it is not easy as yet to determine in what areas. As far as we can judge, cattle were first tamed north of the mountains running from the Caucasus to the Hindu Kush; sheep, on the other hand, and probably goats as well, seem to have been domesticated on the south of the range, but whether in the highlands of Persia, Syria, Palestine or even Arabia, it is not yet possible to determine.

In some such ways as these cattle, sheep and goats were brought under the control of man at an early date, and forced to yield him their hides and wool as well as their milk and flesh whenever he desired it. How early this took place is uncertain. It cannot well have been later than 5000 B.C., and it seems unlikely that it was earlier than 6000 or, at the earliest, 6500 B.C.

Beasts were useful to man, not only to supply him with food and the materials for making his clothes, for life was strenuous for our early ancestors, who had to travel many miles to find fresh pastures for their newly tamed possessions, and as time went on they acquired a number of goods that they desired to carry with them. They soon felt themselves in need of beasts of burden. In the course of time they succeeded in compelling three beasts to share these duties with them: the horse, the ass, and the camel.

Our evidence for the earliest use of these animals is scanty, and we cannot be sure that we know the beginning of the story. The ass was used at a very early date,

both in Egypt and in Mesopotamia, but it is impossible to say at present to which region to ascribe the priority. Towards the close of the predynastic period in Egypt, just before 3400 B.C., the Libyan tribes, who dwelt in the desert to the west of the Nile Delta, possessed large herds of asses, and this indicates that this animal had been known to and possessed by them for a long time. At Ur, in Mesopotamia, asses were used by those kings and queens who were buried in the famous death-pits, accompanied by their slain retainers, and these must be relegated to quite as early a date, and are probably much earlier. All our evidence goes to show that asses had been tamed, and were used as beasts of burden, both in Egypt and Mesopotamia, between 4000 and 3000 B.C., and may have been first domesticated at a considerably earlier date.

The camel is the next beast of burden to come to our notice. This beast was in common use in Egypt during the the time of the Middle Kingdom, and it is believed by some that it had made its appearance in that land before the close of the Old Kingdom, though this rests on one piece of evidence of rather doubtful validity. The camel is, it is said, still found wild in the Gobi Desert to the north-west of China, and probably at an earlier time had a wider range. It seems to have been domesticated in this region fairly early, since a camel's skull was found in a prehistoric village, the remains of which were unearthed near Kiev, in Russia, and which date from well before 2000 B.C. Taking everything into consideration we must conclude that the camel was first domesticated, almost certainly in East Central Asia, between 3000 and 2000 B.C., or perhaps a little earlier.

There can be no doubt that the horse was first tamed in the grasslands of Central Asia, for it is only there that the wild horse, known as Przewalsky's horse, is to be found to-day. The first mention of the horse that has been met

with is in a document from Babylon, dating from before 2000 B.C., in which it is called the ass from the East. This indicates the direction from which it came, but it does not seem to have been introduced into Mesopotamia before the arrival of the Kassite conquerors about 1746 B.C. We have, however, some reasons for believing that it had been tamed at an earlier date. Into the north of Mesopotamia there had arrived some centuries earlier a people known as the Kharians, some of whom were later called the Mitanni. These, we know, were great horsemen. They occupied the country around Haran, which lies between the Tigris and the Euphrates just below the points at which they emerge from the mountains, and they seem to have arrived in that district from the North-east, probably from the Persian plateau, whence later the Kassites descended upon Mesopotamia. The horse was well known also to the Hittites, the capital of whose kingdom lay in the centre of Asia Minor. These people are believed to have arrived there about 1900 B.C. from the North-west. All this evidence tends to show that the horse was used as a means of transport both in Persia and upon the Russian steppe well before 2000 B.C. It seems likely that it was first tamed in that part of the world, or still farther east in Mongolia, as early as 3000 B.C., if not before that date.

We have now shown, as far as it is possible at present, how, where and when the principal animals that minister to man's needs were first tamed. Only one remains, the dog. The dog is man's companion and was first used, as it is sometimes used to-day, to help him in the chase. Its domestication goes back to a still earlier time, certainly to the Mesolithic Age, for bones gnawed by dogs have been found in the shell-mounds of Denmark. It is thought by some that the dog was man's companion even in the Upper Palæolithic Age.

a. Prevalsky's horse

b. Predynastic slate palette, showing herd of asses

PLATE XXXI. WILD HORSE AND ASSES

[*Face page* 100

Plate XXXII. Straw Granary in the Fayûm]

Face page 101]

CHAPTER XI

HOW GRAIN WAS FIRST GROWN

We have already seen that at the dawn of the Mesolithic Age the forests spread over the greater part of Europe, and covered, too, many other parts of the Old World. Only in large stretches of Asia, Turkistan, Southern Siberia and Mongolia was there any extensive open country, and these great steppes or grasslands extended westwards into South Russia, and to some extent into Hungary and across the Ukraine into Polish Galicia. Farther south, too, there were extensive grasslands, stretching from the Atlantic coast, across what is now the Sahara Desert, as far as Baluchistan and even to the Ganges Valley. This southern steppe, as we may call it to distinguish it from that first described, was only broken by the Nile Valley, the Red Sea, Mesopotamia and the Persian Gulf and the valley of the Indus. It was, however, for all practical purposes, a continuous stretch of grassland, with a southern prolongation down East Africa as far as the Cape. As, however, the forest belt advanced over Western Europe, much of the Sahara became desert, and most of its inhabitants spread in various directions, northward over West Europe, eastward to India and Ceylon, and southward to the Cape of Good Hope.

In our last chapter we described the way in which the inhabitants of these grasslands had continued their practice of hunting, to which they had been accustomed during Palæolithic times, and we saw how from hunters

they came, by slow degrees, to acquire command over their victims and ultimately reached the pastoral state, taming wild cattle, horses and, perhaps, camels in the northern steppe, wild asses in the southern, and sheep and goats in the open parts of the mountain region that lay between. We must now return to the less active folk, who had stayed behind, cut off by the dense woodlands from their more robust contemporaries.

In some parts of Europe, where there were limestone hills or stretches of sandy wastes, some of these folk, especially those recently arrived from North Africa, contrived to obtain a scanty living by hunting small animals and birds, but the majority, especially in West and North Europe, settled down by the side of the seashore, or by the banks of lakes and streams, and lived mainly on shell-fish and such other products of the waters as they were able to collect. Settlements of these people, consisting largely of shells of molluscs, with a few poor implements of flint and bone, have been found from the mouth of the Tagus, in Portugal, to the shores of Lake Ladoga, in North Russia. They were the miserable descendants of the Palæolithic hunters, who have left us magnificent samples of their cave art, and their life was like that of the present inhabitants of Tierra del Fuego. For some thousands of years they lived in this way, with very little change in their manner of life, which showed no improvement to the end, and they might have continued so indefinitely, like the aborigines of Australia, had not a better way of living been introduced among them from a distant quarter.

It seems probable that the people dwelling in other parts of the wooded zone were leading an equally miserable and hungry existence, but at present we know little about them and their ways, for few, if any, remains,

dating from this time, have been discovered, or at any rate recognised. Only in one spot have important remains come to light, and these quite recently, for they were found in 1931 in Palestine, and will be described later on, for they have an important bearing on the subject of this chapter.

We see, then, that during the Mesolithic period many of the people, all in fact who were not on the open grasslands, were miserable and hungry, and were feeding largely on shell-fish; doubtless they supplemented this meagre fare with other wild products when in season, and we can well imagine that they made full use of edible roots, nuts, berries and even seeds. This is the practice of most of the people living to-day in similar conditions, especially the inhabitants of Tierra del Fuego and the aborigines of Australia. Some of the inhabitants of the last named continent, especially in North Queensland, make a practice of collecting the seeds of some of the grasses growing there and using them for food in the autumn. A similar practice has been observed in the upper valley of the Nile, where an agricultural people were found living on very unpalatable seeds one winter, after the summer's drought had caused their crops to fail. It must, we must believe, have been some such practice as this that led some Mesolithic folk to sow the seeds of some wild grasses, and thus become growers of grain.

If we are to find out where this practice first arose, and to determine where and when the art of agriculture was first discovered, we must ascertain what grain it was that was first grown, and where that grain grew wild. The chief grain crops grown throughout the world to-day are: wheat, barley, oats, rye, rice and maize, and it seems probable that it was one of these with which the first experiment was made. We may safely

rule out maize, since it grew wild only in the New World, and there civilization, even the ancient civilization of Central America, is relatively modern as compared with some of those in the Old World. Rice grows wild in the New World, too, but also in the monsoon countries of South-east Asia, such as India and the southern half of China. Although evidence of relatively early civilizations has recently come to light in both these countries, neither of them is nearly so old as those of Mesopotamia and Egypt; moreover the earliest civilization of China is confined to the north, and, judging by its distribution, it seems to have entered that country from the north-east, from the southern fringe of the Gobi Desert.

Rye, so Vavilov tells us, is a common weed among certain crops of wheat, especially in some parts of Asia. At higher altitudes the rye, being the hardier grain, often grows well at the expense of the wheat, and in Afghanistan it frequently happens that when wheat has been sown only rye is harvested. What is true of high altitudes is true also of northern latitudes, and so it often happens that in northern and cold countries, as well as in high altitudes, rye has become to a great extent a substitute for wheat. Oats, it is believed, have not been grown for long, in fact it is often stated that the cultivation of oats was unknown until it was introduced from the north by the Germanic tribes after the downfall of the Roman Empire. This may be true, but some oats were noted among some stores of grain found in a pit-dwelling of the Early Iron Age in Wiltshire. This may indicate that oats were grown in Britain before the arrival of the Romans, though it is equally possible that the plants had been growing as weeds in the fields of wheat and that both grains had been harvested and threshed together.

We are left now with only wheat and barley. Wild

barley has a larger grain than wild wheat, and is found to-day growing over a wider area. It would, therefore, be the more conspicuous grain of the two and the one more readily met with, for it is still found growing wild over the greater part of South-west Asia, from the Mediterranean Sea to Afghanistan. On two occasions during the latter part of the nineteenth century it was found growing wild in Tripoli, for in 1890 Dr. Schweinfurth discovered it at Badia, in Marmarica, and before that, in 1887, Dr. Taubert had found it in the Wadi Dernia, in Cyrenaica. These, however, are the only two spots from which it has been recorded on the African continent. It is true that Vavilov has claimed that it grew wild both in Morocco and Abyssinia, but no records of its discovery have been noted for either of these two regions, and Dr. Harlan, of the United States Bureau of Agriculture, has informed the author that he had wandered over the uplands of Abyssinia at the right time of the year, searching for specimens of wild barley, and searching in vain. While it is possible that barley, the larger and more widely distributed, was the first grain-bearing plant to be cultivated, all the evidence that we possess at present goes to show that its use was preceded by that of wheat, a plant that has a much more limited habitat.

We must now examine the possibilities of wheat, which, as will be seen, is a much more complicated question. A great many varieties of wheat are grown at the present day, most of them the result of careful selection and hybridisation in modern times, though several of them go back to a respectable antiquity. All, however, may be looked upon as varieties of three species, which are known as the common or bread wheat, emmer and einkorn. Bread wheat is the kind most grown to-day, though both emmer and einkorn are cultivated in some out-of-the-way mountain regions, usually, however, only

for their straw. The two last are small and poor grains, and we might reasonably expect that a bread wheat was the first to be cultivated. It cannot, however, have been so, for bread wheat has never been found growing wild. It is agreed by all botanists that it is not a natural species, but a hyrbid, and it is generally believed that it has been purposely hybridised by man. As to its parents there is some difference of opinion. Professor Percival is convinced that it is a hybrid between wild emmer and some species of *Aegilops*, a grass that has a fairly wide distribution in the north sub-tropical zone. Professor Ruggles Gates, on the other hand, has suggested that it was the result of crossing wild emmer with wild einkorn, but recently he has expressed a doubt as to the validity of this suggestion. It is clear, then, that the first grain-plant to be cultivated must have been wild emmer or wild einkorn.

Let us now consider the possibilities of einkorn. This is a small and poor plant, with only one grain on a stalk. It has a fairly wide distribution throughout South-west Asia and is found also in South-east Europe. Einkorn is still found growing wild in most parts of Asia Minor, from the coast lands near Smyrna as far east as Kurdistan on the borders of Persia; it has also been found in North Syria. A smaller variety has been noticed in Greece, between Nauplia and Corinth, and it is found widely distributed on the slopes of low hills in Thessaly, Boeotia and Achaia, as well as in South Bulgaria and on loamy soils in the vineyards of Southern Yugo-Slavia. Three varieties of it were discovered in 1909 near Balaclava in the Crimea, and it has also been reported from the eastern end of the Caucasus. Its European distribution seems confined to the basins of the Ægean and Black Seas, except that it has spread up the Vardar Valley and crossed the divide, for it has

been noted growing as a weed in vineyards in the upper part of the Morava Valley.

Wild emmer has a much more restricted range; in fact until recent years no certain evidence of its existence had been found. Berosus, writing about 300 B.C. said that it grew wild in the land of the Babylonians between the Tigris and the Euphrates. In 1787 André Michaux saw what he called "spelt," by which it is believed he meant emmer, growing wild in Persia, north of Hamadan, while at the beginning of the nineteenth century Olivier found it growing wild with wheat and barley in a ravine near the banks of the Euphrates, north-west of Anah. It is not certain that any of these notices refer to wild emmer, though, in Professor Percival's opinion, it is probable that they do so.

What was undoubtedly the true wild emmer was found in 1906 by Aaronsohn growing at the foot of Jebel Safed, in Syria, and later the same botanist found it at Rashey-ya, and elsewhere on the slopes of Mount Hermon, as well as on the plateau of Es-Salt, east of the Jordan Valley. He found it growing in crevices of limestone rocks in dry situations as high as six thousand feet above the level of the Mediterranean, and in the Jordan Valley as low as between three hundred and five hundred feet below that level. In 1910 Theodor Strauss collected a few specimens of what he believed to be wild emmer in the mountainous region of Western Persia, near Kerind, between Kermanshah and Bagdad. Percival, however, says that Strauss only found one plant and that it might have been a stray.

Thus as far as our evidence went a few years ago emmer had been found growing wild only along a strip of country ranging from South Syria to the mountains of Moab. Though claims have been made for its occurrence farther east, as far as the borders of Persia, it seems possible that

some of the plants found there were wild einkorn, or emmer that had escaped from cultivation. In 1930, however, Professor Kalantarian, of the University of Erivan in Armenia, sent to the author a specimen of wild emmer that he had found in the neighbourhood of that town. Professor Percival, to whom this specimen had been submitted for verification, stated that Professor Zhukovsky of Leningrad had recently reported a new variety of wild wheat from Georgia. Percival had grown some plants of this from seed sent to him by Zhukovsky, and said that it was clearly a local variety of wild emmer. It would seem from this recent evidence that wild emmer is to be found in various places between South Palestine and the Caucasus, and that it might at one time have extended as far east as Persia.

A claim has been made that at one time the area of wild emmer extended across the peninsula of Sinai into Egypt, but no positive evidence of this is available. It is argued that in the time of the Badarians, mentioned in Chapter IV, about 5000 B.C., trees were growing in Egypt and that the climate was then not nearly so dry as it has since become. In that case, it is thought, wild emmer, wild barley and many other plants not found there to-day may have been common on the hill sides in Egypt. It is, of course, possible that this may have been so, but positive evidence on this point is for the moment lacking. At an early date, as we shall see, some of the inhabitants of Egypt were growing emmer, but it is possible that these people had come from Asia, bringing with them the knowledge of agriculture and the seeds of emmer, or they may have derived both from other immigrants from that continent.

Our investigations so far have shown us that wheat and barley were the first grain-bearing plants to be

cultivated by man, and that of these it is likely that wheat took the precedence. Of the three types of wheat, only two are found wild, and, as we shall see, it seems almost certain that emmer was the first to be cultivated. The first experiment in cultivation must have taken place where emmer grew wild, and this seems to have been confined to a relatively restricted area in South-west Asia. Lastly the experiment must have been made in Mesolithic times, since Neolithic culture is always associated with agriculture; we may therefore assert that the discovery of the art of grain-growing, or its introduction into any region, automatically brought the Mesolithic Age to an end in that part. We must now see what evidence we can find in support of these conclusions from the results achieved by the study of prehistoric archæology and the labours of excavators.

Some years ago Professor Reisner opened a number of graves in Upper Egypt, which from their contents he relegated to an early stage of the predynastic period, but it is not quite clear whether they belonged to the Early or Amratian phase or to an early stage in the Middle or Gerzean phase. The contents of the stomachs of the occupants of these graves were sent by Professor Elliot-Smith to Dr. Fritz Netolitzsky, of Czernowitz, who found in them husks of barley. From this it was hastily assumed that the earliest predynastic Egyptians were the first to cultivate grain and that this grain was barley. Needless to say all this does not follow from the evidence. It is now doubted whether these graves belonged to the Early or Amratian phase, and it has been pointed out that the presence of barley was detected by the undigested husks, that are with difficulty separated from the grain, and that, if these people had eaten wheat, whence the husks are readily separated, no evidence of this would have remained.

This discovery has now but an academic interest, for a few years ago Mr. Guy Brunton discovered the still earlier Badarian civilization, and in his second season removed from one of the untouched Badarian graves a pot containing grain that has been identified by Sir Roland Biffen as emmer. Later on he found another and still earlier civilization, which he termed Tasian. In the graves of this period he has found some well-made pottery, but so far no grain, though from one of them he took a "grit-stone grinder," which might have been a primitive corn-grinder or else, perhaps, a stone on which to sharpen stone axes. We may be certain, therefore, that emmer was grown in Egypt as early as Badarian times, about 5000 B.C., and possibly by the still earlier Tasians.

It was in the year that Brunton first met with the Badarian graves that Miss Caton-Thompson discovered another primitive civilization in the desert around Fayûm. Here she found straw granaries full of grain, most of it emmer, and some curiously flaked flints that had been fitted in to wooden slots for use as sickles. At first she thought that this Fayûm civilization was much later than the Badarian, but further excavations showed that they were roughly contemporary. It is uncertain at present which is the earlier, but Miss Caton-Thompson is now engaged in investigations in the Khargeh Oasis, in which similar remains have been found, and she is hopeful that before long she will be in a position to determine with precision which of these two civilizations is the older.

We must now turn to Mesopotamia, where the problem is full of complications. As we have seen there is no general agreement as to the dates of the remains found in this area that are earlier than 3100 B.C., though clearly some of them go back to a much more remote

time. We have lists of dynasties and kings with the lengths of their reigns, but it is believed that some of these dynasties were ruling at the same time, though no two authorities agree as to the extent to which this took place. These lists make reference to a flood that took place before most of the kings were ruling, for only about ten monarchs are described as antediluvian. Then there are a number of graves attributed to the first dynasty of Ur, the fourth after the Flood, and there are the great death-pits, containing the burials of kings and queens with men-at-arms and attendant maids, sacrificed to accompany their sovereigns to another world. These are many years, and probably several centuries, older than the graves attributed to the first dynasty of Ur. Lastly below a deep pile of broken pottery, forty feet thick, into which the great death-pits had been sunk, and consequently very many years earlier, Mr. Woolley made a great discovery in 1929. This was a layer of grey clay, eight feet thick, which he attributed to the Flood. Beneath this again he found evidence of another and earlier civilization. Similar evidence of a flood, in fact of several, was found about the same time higher up the river at the site of the ancient city of Kish, and here were found beneath the lowest flood layer remains of a number of early civilizations, one lying above the other.

In 1918 Mr. R. Campbell Thompson paid a visit to Abu Shahrein, the site of the ancient Eridu, a great mound in the desert nearly a day's journey from the mouth of the Euphrates. Here he found vast quantities of broken pottery of a type hitherto unknown; this pottery, unlike that met with up to that time in Mesopotamia, was a painted ware, with dark designs upon a light buff or greenish ground. A few years later Dr. H. R. Hall found similar pottery at Tell al 'Ubaid,

about four miles from Ur, and with it many remains of hoes and sickles. The makers of this pottery, al 'Ubaid ware as it is called, were clearly cultivators of grain. In 1923 Mr. Woolley carried out further excavations at Tell al 'Ubaid, and found much more pottery and evidence of agriculture; as the result of this work he suggested that perhaps this civilization had existed before the Flood, and so was antediluvian.

A little later another expedition, which had been exploring the site of the ancient city of Kish, carried out some excavations at a deserted village near Jemdet Nasr, about sixteen miles north-east of that site. Here they found a quantity of painted pottery, not with dark decoration on a buff green ground as at Tell al 'Ubaid, but painted in many colours, the most prominent of which was a rich purplish red. This is known as polychrome or Jemdet Nasr ware. The most remarkable discovery, however, was a pot containing grain, either emmer or some primitive form of bread wheat; it is uncertain which, as the experts to whom the samples were referred differed on this point.

Thus we have evidence of two civilizations, one with black and buff pottery, the other with a ware of many colours, and Dr. H. Frankfort has suggested that these wares belonged to two peoples, a highland folk who had come from the mountainous regions of Perisa to settle at Tell al 'Ubaid, Abu Shahrein and elsewhere on the plain, and the other a people of the lowlands, who had arrived in Mesopotamia from the direction of North Syria. This suggestion was to some extent corroborated when in 1929 Professor Herzfeld found quantities of the black and buff ware in deserted villages around Teheran in Persia.

In the early spring of 1929 the world was startled by the news that Mr. Woolley, who had been excavating

for some years at Ur, had found evidence of the Flood in a thick layer of water-laid clay below the huge pile of rubbish into which the great death-pits had been sunk. Beneath the layer he found quantities of Tell al 'Ubaid pottery and a few fragments of the polychrome ware of Jemdet Nasr. Soon afterwards the excavators at Kish reported the discovery of evidence of three or four floods, the lowest and earliest of which can be shown to be that which laid down the thick deposit at Ur. Beneath the first flood layer at Kish was a deposit, one foot six inches in thickness, filled with fragments of the polychrome ware of Jemdet Nasr, and beneath this again eight feet six inches of soil, full of three other kinds of pottery of hitherto unknown types.

Only a small pit has so far been dug into this lowest layer at Kish, and as yet no certain evidence of agriculture has been obtained, but it seems improbable that people could have lived on the spot long enough to leave so deep a deposit of rubbish unless they had other means of subsistence than could be obtained by the precarious life of the hunter. As in the case of the Tasians in Egypt, these earliest inhabitants of Kish were almost certainly growers of grain. As to the date of these early deposits there is at present no general agreement, but the present author has elsewhere given his reasons for believing that the earliest deposit at Kish must go back to 5000 B.C. if not beyond, and was therefore contemporary with the Badarian and perhaps even the Tasian civilization in Egypt.

Thus our earliest evidence for grain growing in both Egypt and Mesopotamia goes back to about 5000 B.C. or perhaps some centuries earlier, yet wild emmer did not, as far as we know, grow in Africa, nor can we be sure that it grew in the land between the rivers. Further than this the Badarian folk had very narrow skulls,

such as are only found to-day among some of the jungle tribes in South India and the East Indies, while some, at any rate, of the Tasians had broad skulls, which, as we have seen, are native to the mountain zone of Asia and Europe. Both, therefore, seem to be intruders into Egypt.

Though our earliest evidence of grain growing, at any rate until the summer of 1931, came from Egypt and Mesopotamia, it is possible that the rudiments of agriculture had been introduced into both these lands from some intermediate place. Professor Breasted had long ago pointed out that from the delta of the Nile, through Palestine, Syria and Mesopotamia to the Persian Gulf, was a long curved area suitable for cultivation, which he called the Fertile Crescent, and within this area he believed that agriculture first arose. Also, as we have seen, wild emmer is found most abundantly in North Syria and Palestine and in few other places. It was reasonable to suspect that agriculture arose somewhere here, and quite lately some evidence has been found pointing to the correctness of this surmise.

In August 1931 Miss Dorothy Garrod reported on various discoveries made during the spring of that year in Palestine. These included skeletons and implements, some of the Le Moustier period and others dating from the Mesolithic Age, the age, it will be remembered, immediately preceding the dawn of agriculture. In the cave at Mugharet-el-Wad, on the side of Mount Carmel, Miss Garrod found a series of mesolithic burials, in which the skeletons were found covered with circlets and necklaces of shell and bone beads. In another cave, Zichron Jacob, at Mugharet-el-Kabara, Mr. Turville Petre found a layer containing mesolithic implements, similar to those found at Mugharet-el-Wad, and among these were lying bone sickle hafts with animal heads

carved at the top, along with a number of bone harpoons. Subsequently in both caves a number of bone sickle-handles were found and fixed in one of these were several sharp flints, which showed signs of having been used for cutting corn.

The presence of these sickle-handles seems to indicate beyond any doubt that the people who had occupied these caves had crops that needed harvesting, while the existence of harpoons among their remains shows us that they had not yet abandoned the hunter's mode of life. We see here clearly a transitional phase between the hunting and the agricultural stages, and we seem to be in the presence of remains left by one of the earliest experimenters in agriculture. It would appear, then, that our conjecture, that agriculture was first practised in Palestine, whence the art travelled both to Egypt and to Mesopotamia, has received ample confirmation, and that wheat, in the form of emmer, was first cultivated not so far from the slopes of Mount Hermon, where Aaronsohn first found the plant growing wild.

CHAPTER XII

EARLY AGRICULTURAL IMPLEMENTS

The introduction of agriculture effected a great revolution in the life of man. Hitherto he had been an exploiter of the wild resources of nature, and had depended for his food on a supply with ever diminishing returns; now he had become a producer and a creator of wealth. Before this revolution his supply of food had been uncertain and insecure; now he was assured of a sufficiency, if he toiled unremittingly at certain seasons of the year in the sweat of his brow. In his earlier condition he had been thoughtless and thriftless, eating his fill and over-gorging himself when his hunting expedition had proved successful, heedless of the time of scarcity and hunger to follow, for his food would not keep in an eatable condition, except under the system of cold storage that had only been possible during the long severe winters of the Ice Age. Now he was forced to become thrifty, for, if he consumed all his grain between harvest and the following seed-time, no seed-corn would be left to supply him with the next season's crop.

This great revolution necessitated great changes, also, in his tools and in his manner of life. Tilling the ground, harvesting the crops, removing the grain from the chaff and preparing it for food, all required new implements and utensils, while the fact that many months had to be spent near his patches of grain, and that there was now little necessity for wandering in search of game, made a settled home an advantage if not a necessity.

It now became possible to build a permanent home, and to furnish it with a number of utensils, required by his improved scale of living, and these need not necessarily be light or unbreakable, since they had no longer to be carried with him on his wanderings. Thus the advent of agriculture saw almost immediately the introduction of agricultural implements, of primitive apparatus for grinding corn, of houses, of pottery, and soon afterwards of many other commodities that made life pleasanter and easier.

It might be thought that the introduction of such a novel industry as agriculture would result in the invention of an entirely new series of implements, specially designed for its performance. Man, however, rarely has made an abrupt start. His advances have usually been by adapting an old contrivance to a new use. In producing his new implements for agriculture he followed his usual rule, and the earliest of his farm tools were adaptations of those with which he had already been familiar.

One of the earliest and simplest implements to be used was the digging-stick. This is a pointed stake, the end of which has sometimes been hardened with fire. Such simple digging-sticks, with a chisel-like end, are used by the aborigines of Australia for procuring roots and tubers, and by some of the North American Indians for the same purpose and for digging up burrowing animals. In Australia, the New Hebrides and Tahiti the soil is broken up by repeated thrusts of the stick, while in Fiji and in some parts of New Guinea the stick is thrust into the ground and then used as a lever. The Fiji implement is somewhat different in shape from the others, for it is a lancet-shaped piece of hard wood about a yard long, and is used for clearing away the brush-wood and coarse grass. The Akikuya of East Africa have a pointed digging-stick about seven feet long, and as thick as a

wrist, while the Cheyenne Indians of North America use implements of various sizes, some of which have a knob at the end for the hand.

A more elaborate type of digging-stick is used by the Bushmen of South Africa, or more precisely by their women-folk. This, known as a *kibi*, is weighted by the attachment at the centre of a heavy perforated stone, secured by a wooden wedge. Armed with this tool these women unearth a prodigious number of "eggs" of the termite or white ant, which, under the name of "Bushmen's rice" is a favourite item in their diet.

As we have already seen, while in the hunting stage our predecessors must have supplemented their meat diet with edible roots, and these became a more important element in the diet of the food-collectors of the Mesolithic Age. We may reasonably expect, therefore, that they would have used some such simple device for acquiring this kind of food. Simple digging-sticks, being made only of wood, have not, of course, survived, unless the wooden implement, found at Clacton-on-Sea, was a tool of this type rather than a spear or javelin, as has hitherto been believed. We are fortunate, however, in having some evidence that the more complex type used by the Bushmen, weighted with a perforated stone, was in use as early as the period of La Madeleine, for a perforated stone, almost exactly like those used by the Bushmen, was found in the cave of Salpétrière, near Pont-du-Gard in the South of France.

Unfortunately this is the only example of this implement that has been reported from the Palæolithic Age, and no clear examples have come to light from the Mesolithic Age, when such a tool would have been more in demand. A number of perforated pebbles have, however, been found, usually on or near the surface, which are usually classed as hammer-heads or mace-heads, and relegated

to the Neolithic or Bronze Ages. Some of these are undoubtedly the heads of hammers, while other may have been used as net-sinkers, but some, with larger holes, may have been used for digging-sticks, and this is specially true of a large one in the Norwich Museum. Being surface finds, often without associations, the dates of these perforated stones are uncertain, and it is possible that some may go back to the Mesolithic Age.

In course of time the digging-stick developed into the spade, and an interesting intermediate type was formerly in use among the Maori of New Zealand. This consisted of a pointed stick, to which had been fixed transversely a piece of wood, strongly bound with cord, to serve as a foot-piece. The Zuni Indians of North America have invented a very similar tool, but in this case the foot rest is in one piece with the shaft. Spade-like tools with foot-rests were not uncommon in many parts both of North and South America, where the blades were sometimes made of shell or stone, and in Peru of copper or bronze. If the spade developed at all in early days, it would have been made of wood only, and so we cannot be surprised that none have been found.

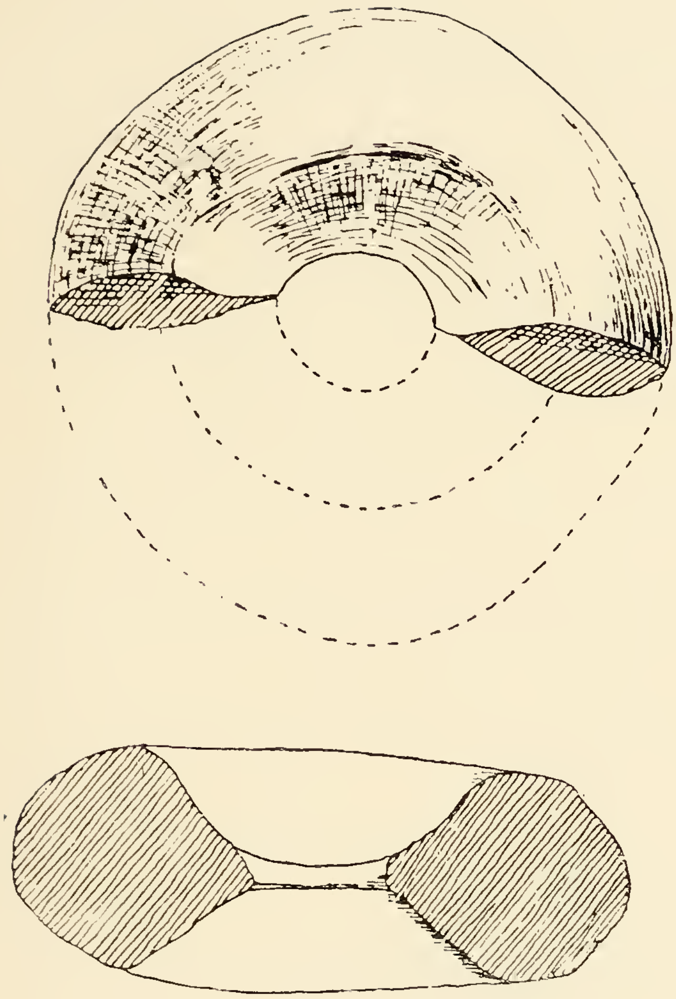
The implement most generally used in early cultivation was the hoe. This is still the chief or only agricultural implement among many primitive peoples, while it is still in general use in gardens in all civilized countries. In its simplest form the hoe has a sharp point, and is more properly a pick. Such picks, made of one piece of wood, were formerly used by the Maori, and certain pick-shaped wooden clubs were used in New Caledonia for planting yams, though their usual purpose was for war. Similar wooden picks are in use in many parts of the African continent, and an implement of the same type and material, known as a *hack*, was used in Sweden until comparatively recent times. The antler of the red

deer, with the butt tine left on, was used as a pick in this country in the Neolithic Age, but not so much for tilling the ground as for excavating ditches in the chalk.

A true hoe is a pick with its point expanded into a blade like an adze. Among primitive peoples the blade is made of many kinds of materials, wood, shell, stone or metal. This implement is widely employed all over the world, except in America and the Pacific Islands, where its use is more restricted. In these latter regions, however, a number of worked stone blades, which are believed to have been those of hoes, have been found unattached to their hafts. The hoe is still used extensively for the cultivation of fields in most parts of Africa south of the Sahara Desert, though usually with an iron blade.

We have already seen that flint core implements, either shaped like axe-heads or else sharpened to a point, have been found in great numbers on Mesolithic sites, especially in the North of Europe, where they seem to have remained in use until the Early Iron Age without any very great change in form. These implements seem to have been used as picks and hoes. During the Mesolithic Age they were doubtless used for digging up edible roots, but they continued in use during later ages for the purpose of agriculture. It has also been suggested that some of the hand-axes, made in the Lower Palæolithic Age, were used for the extraction of roots.

That the early growers of grain in Mesopotamia used the hoe is clear from the remains found by Dr. H. R. Hall at Tell al 'Ubaid, near Ur. Here among a great mass of fragments of painted pottery, decorated with black designs on a greenish buff ground, which we now know was in use in the days before the Flood, Hall found a number of objects that were clearly the heads of hoes, a few of them of stone, but the majority of pottery or baked clay. The hoe seems to have been used early in



a.

b.

a. Perforated stone from cave of Salpétrière
b. Bushman kibi or digging stick

PLATE XXXIII. DIGGING-STICKS

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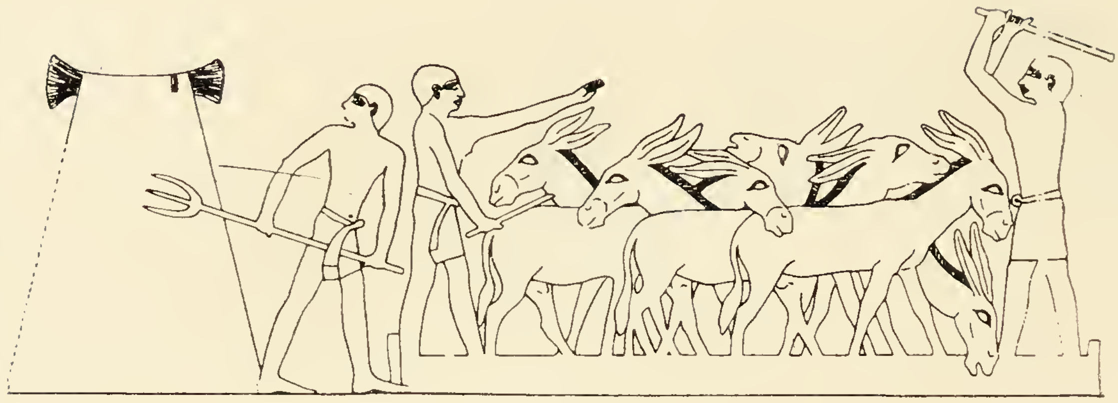
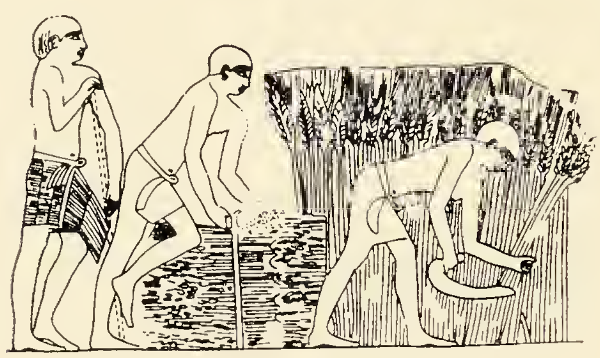
THE SHEAVES ARE SPREAD OUT ON A THRESHING-FLOOR AND DONKEYS, KEPT MOVING IN A CIRCLE BY FREQUENT BLOWS FROM STICKS, TREAD OUT THE GRAIN. AT THE LEFT THE STALKS ARE COLLECTED WITH A PITCH-FORK INTO A HUGE STACK.



THRESHING

FROM A WALL-RELIEF IN THE TOMB OF RAEMKAI FROM SAKKARA, NOW IN THE METROPOLITAN MUSEUM OF ART DYN. V (ABOUT 2750-2625 B.C.)

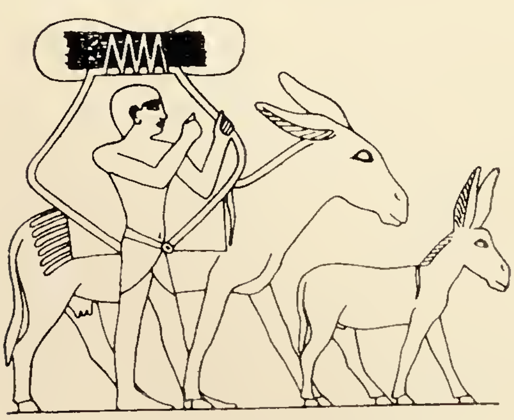
REAPER WITH SICKLE CUTS THE GRAIN WHICH HIS COMPANION BINDS INTO SHEAVES.
AT LEFT, AN OVERSEER LEANS ON A STAFF.



REAPING

FROM A WALL-RELIEF IN THE TOMB OF RAEMKAI FROM SAKKARA, NOW IN THE METROPOLITAN MUSEUM OF ART DYN. V (ABOUT 2750-2625 B.C.)

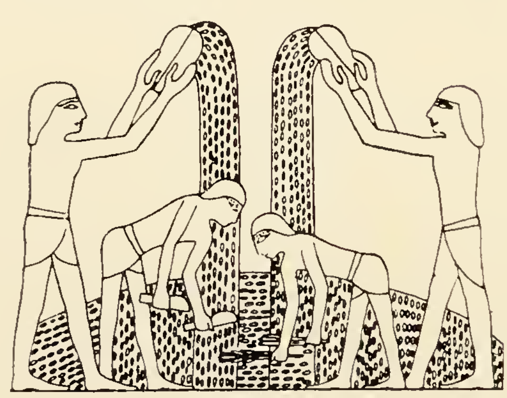
THE SHEAVES ARE CARRIED OFF TO THE THRESHING-FLOOR LOADED IN A BIG PACK ON A DONKEY ACCOMPANIED BY HER FOAL.



DONKEY CARRYING GRAIN

FROM A WALL-RELIEF IN THE TOMB OF TI AT SAKKARA DYN. V (ABOUT 2750-2625 B.C.)

WINNOWING IS DONE BY LIFTING THE GRAIN HIGH IN THE AIR IN A PAIR OF WINNOWING SCOOPS HELD EDGE TO EDGE WHICH WHEN SEPARATED ALLOW THE GRAIN TO FALL WHILE THE CHAFF IS CARRIED ASIDE BY THE WIND. A PILE IS SWEPT TOGETHER BY A GIRL WITH A BROOM IN EACH HAND.



WINNOWING

FROM A WALL-RELIEF IN THE TOMB OF PAHERI AT EL KAB. DYN. XVIII (ABOUT 1500 B.C.)

PLATE XXXIV. EARLY AGRICULTURAL OPERATIONS IN EGYPT

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Egypt, where the blade was often made of wood, though sometimes tipped with copper. These blades were of considerable length, and a twisted rope was strung between the handle end of the haft and the blade end of the hoe to keep the two parts in place.

The hoe remained in use as the chief agricultural implement in most parts of North and West Europe until the beginning of the Christian era, but in the Mediterranean countries and the Near East it gave place at an early date to the plough, which was certainly in use in Egypt as early as the Fifth Dynasty.

The plough, as we have seen, at an early date replaced, to some extent at least, the hoe for cultivating the soil in Egypt, but the earliest plough, of which we have a picture in the tomb of Ti at Sakkara, near Cairo, very closely resembles a hoe shown in the same scene, but the haft is much larger and stouter, and is affixed to a cross pole tied in front of the horns of a pair of oxen, which are drawing the plough. Here we see how the one implement passed imperceptibly into the other, for in the picture in question, carved in very low relief on one of the inside walls of the tomb, both are shown in use side by side.

The same change seems to have taken place in more than one country, for Swedish tradition relates how the wooden pick or *hack* of that country gradually became converted into a plough. First of all the wooden *hack* was made much heavier and dragged by men through the ground, thus making a long simple furrow. Then the implement was made in two pieces, so that the ploughman had a handle by which to steer, while the men had a pole to drag. Then the point of the *hack* was shod with iron and lastly a contrivance was added to enable a pair of oxen or of mares to drag it. The simplest ploughs in many parts of the Old World are merely like

large hoes, a pole with a branch curving back and pointed. Usually this point is shod with iron, but the writer has seen a Turk in Asia Minor ploughing with a simple implement of this kind, without any metal share, drawn by a pair of yearling steers. He has seen one very little more advanced in type, but with an iron share, being drawn in the Delta of the Nile by a donkey and a small camel, very unequal yoke-mates. In all these simple ploughs the pole is attached to a cross-bar or yoke, sometimes, as in the case quoted from Egypt, attached to the front of the horns, but more frequently of heavier make, laid on the backs of the beasts' necks and securely fastened. How early the plough was introduced into Greece and Italy is uncertain, but it seems to have been in use in North Italy as early as the Bronze Age, judging from a rock-carving found in the Ligurian Alps. In spite of what has been written to the contrary it is doubtful whether this implement was used in Britain before it was introduced by the Romans in the first century of our era.

Such is in very brief outline the story of the implements used in early days for the cultivation of the land preparatory to the growing of crops. We must now consider how they were harvested. Probably in the earliest days of agriculture the heads of grain were cut from the stalks by flint knives, but before the practice of grain growing had advanced very far men had taken to using sickles. Perhaps the earliest evidence that we possess of sickles came to light only quite recently, for in the summer of 1931 Miss Garrod and others made some remarkable discoveries in some caves in Palestine, to which reference has already been made.

In the Zichron Jacob cave, at Mugharet-el-Kabara, Mr. Turville Petre found a deposit containing flint implements of typical Mesolithic form, and from this layer he extracted

several hafts for sickle-blades. Similar tools were also found by Miss Garrod. These hafts were made of bone, with animals' heads carved on the top. Thus we have evidence of the existence of sickles from a deposit that must date from the very dawn of agriculture, before these early grain-growers had altogether given up their Mesolithic way of life. Miss Garrod has shown to the author some of the flint blades that were fitted into these hafts, some of which she found still in position. They closely resemble those that Miss Caton-Thompson found in the Fayûm, in the Egyptian desert, in the winter of 1924; these were a number of flints with serrated or saw-like edges, some of which she found fixed in a wooden haft of sickle-like form. Since with the same culture Miss Caton-Thompson found straw baskets, buried in the sand and full of grain, it was clear that these early Fayûm people were grain-growers, and the saw-like flints, fixed into the wooden hafts, were clearly the sickles with which they had harvested their crops. We may feel sure, then, that the similar serrated flints with their bone hafts, found in Palestine by Miss Garrod and Mr. Turville Petre, were used for a like purpose, and that similar flint sickles were most probably in use elsewhere during these early times, though at Tell al 'Ubaid near Ur, since flint was not to be found, and obsidian, the only satisfactory substitute, could not be obtained except with great difficulty, and sickles were made of baked clay, and, as these rapidly lost their edges, they were as quickly discarded, so that a very great number were found lying about.

Sickles with serrated flint blades have been found on many sites of different periods in the Near East, especially in Egypt and Palestine. Though wood was often used for the hafts, bone was almost if not quite as common. Some of these early sickles bear a curious resemblance

to the jawbone of a horse, and this leads one to wonder whether a jaw bone, not of a horse, for that animal was unknown in the Near East at that time, but of an ass, which was familiar to them from the earliest times, was one of the first objects to be used for a sickle, and that in time serrated flints were inserted in the place of the teeth. If this were so, and the custom had survived until much later days in Palestine, we can understand how it was that Samson found ready to his hand the jawbone of an ass, with which he smote the Philistines.

Sickles of copper had replaced those of flint in Egypt by the time of the Old Kingdom, and, when the alloy of bronze became known, bronze sickles of various types were made in Europe, especially in North Italy and Central Europe. These were complete blades, usually of very thin bronze, strengthened by ribs running part of their length; they were usually attached to their hafts by a couple of rivets, but a few have been found, rather smaller and thicker, cast in one piece with a socket, into which the haft could be inserted.

When in due course it was found possible to forge iron, and this metal took the place of bronze for cutting implements, the blades of sickles grew larger and flatter, and for some purposes they were considerably enlarged and their hafts correspondingly lengthened, with the addition of two peg-like handles set in them, and thus they became scythes, which were more convenient for mowing hay.

When the corn had been cut it was necessary to thresh it to extract the grain from the ear. The natives of Australia extract the seeds of some wild grasses by brushing and squeezing the heads between their fingers, but this is a slow process. Some of the natives of North America, who gather wild rice, thresh out the grain by treading it out beneath their feet, and this practice may well

have been adopted by the earliest grain growers. It was not long, we may imagine, before it was discovered that the hooves of cattle were more effective for this purpose than the bare feet of men, and the custom of making the cattle tread out the corn must have been introduced quite early, and lasted well into historic times. The present writer has seen this method adopted in recent years on a up-country ranch in British Columbia.

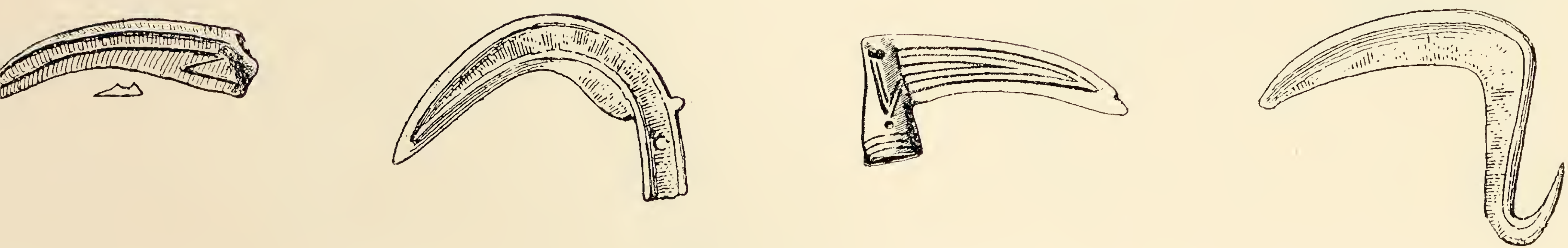
The Romans had a threshing appliance known as the *tribulum.* This was a kind of heavy sledge, the underside of which was studded with fragments of stone. This was loaded with one or two drivers, and dragged over the threshing-floor by a yoke of oxen. A similar sledge, called a *dhoukani,* is used to this day in Cyprus, and something very like it was worked not long ago in the Azores. This method is clearly of very great antiquity, for among the simple objects found by Mr. Woolley at Tell al 'Ubaid were a number of stones, which he considered were "the culters of the threshing-machines." If he is correct in his surmise, the *tribulum* has a very long history, beginning as it does before the Flood and surviving to our own day.

The method of threshing by beating the ears of corn with a stick has been widely used in many countries, but the flail, two sticks fastened together with a swivel joint, seems to have been a relatively modern invention. It was not known in this country much, if at all, before the eleventh century, and is still in use in some districts, though during the last century and a half this implement has gradually given way to the machine-thresher, which was first invented in the middle of the eighteenth century.

The separation of the grain from the chaff is called winnowing. At first it is probable that this was left to the wind, the grain being tossed up by hand. After a time, especially in countries where the wind is not always

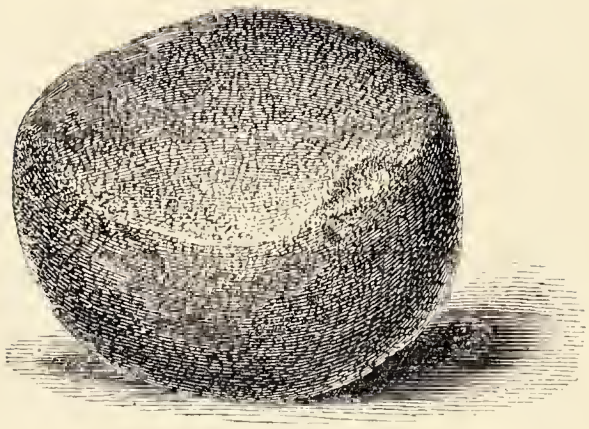
blowing, a fan was adopted to ensure a draught. This method was in use in Egypt as early as the time of the Old Kingdom, and was employed in Palestine at a fairly early date. The present writer has seen this practised in Japan. Since the employment of the threshing-machine, which winnows as well as threshes, such simple processes have gone out of use in most civilized lands.

a. Flint sickle from the Fayûm

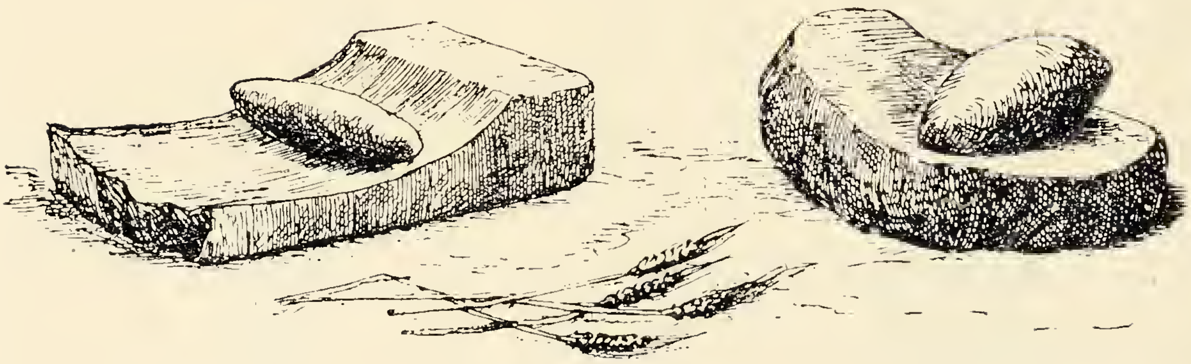


b. Bronze sickles dating from the Bronze Age

PLATE XXXV. FLINT AND BRONZE SICKLES



a. Grain crusher from Kent's cavern



b. Saddle querns

c. A Metata

Plate XXXVI. Primitive Implements for Crushing Grain

CHAPTER XIII

THE EARLIEST MILLS

We have now seen how man discovered how to grow grain and the implements that he first used for the cultivation of his land; we have noted, too, how he reaped his crops and extracted the grain from the ear. Grain, straight from the threshing-floor, is not, however, either a palatable or a digestible article of diet. Something more was needed before it could be converted into a wholesome food. To-day grain is ground in a mill and converted into flour, after which it is mixed with water and a little yeast, and after much kneading is baked in an oven and converted into bread. It was a long time, however, before men could produce flour, and we must first consider the earliest methods by which the grain could be made fit for food.

The simplest way of converting grain into a suitable foodstuff is by bruising or crushing it. Such methods are employed by many primitive people, even by some who have not yet reached the stage of growing grain. Among the chief articles of food used by the natives in the region of Cape York in Australia are the seeds of a climbing bean, *Entada scandens*, which is found growing wild in that part of the country. These are pounded upon a round, flat-topped stone by means of another, long and conical, which can be held in the hands. These stones are not shaped in any way by these people, who are content to select the most suitable that they find lying about. If a flat stone of convenient size cannot be found, the beans are crushed upon the surface of a flat rock.

The Seneca Indians of North America boil their maize and crush it between two stones, the Omahas in the same continent crush it in depressions in the rocks, while the Oregon Indians pound the capsules of the yellow water-lily, *Nuphar advena*, in the same way, and the Indians of the Yosemite Valley pound acorns with spherical stone balls. The stone crusher or pestle is used in many parts of North America, and is usually a bell-shaped implement with a flat or only slightly convex base, usually made of some crystalline rock. The stone grain-crusher or pestle and mortar are used in many parts of the world besides America, though in some regions of that continent wooden implements are used for this purpose, and this is usual in Africa and in Eastern Asia.

There is some reason for believing that crushers of this type were used long before grain was grown, perhaps for crushing acorns, as was the custom of the Indians of the Yosemite Valley. A large pebble of coarse red sandstone, very much battered on its surface, was found in 1865, in the deposit of red cave earth in Kent's Cavern, Torquay. Though by some this has been called a hammer-stone its size and shape make it appear more probable that it had been used for crushing nuts or acorns. It has been said that a ball of granite was found in the same deposit, and it is likely that this had been used for the same purpose. The red cave earth on this site produced remains of the Middle and Upper Palæolithic Age, and so it is possible that a crusher, the predecessor of early grain crushers, may go back to the time of Neanderthal man, or at least to that of the earliest modern men to appear in England.

Crushers of this type, then, in all probability, were in use before corn was known, and there is little doubt that the earliest grain growers used these implements to crush their corn before baking it into some kind of biscuit.

What was thought might be a corn-grinder has been found in a Tasian grave in Egypt, and several have come from Badarian graves; it is said that a number of these were found in the bottom layer on the site of Susa, the pottery from which closely resembles that from Tell al 'Ubaid and that found by Woolley beneath the Flood deposit at Ur. This type of implement remained long in use. What were described as "rudely cut, nearly globular, stone instruments for flour grinding" were found in great numbers on the site of Troy, from the earliest up to the third settlement on that site, so that this method of crushing corn must have been used there certainly until about 1700 B.C. Similar crushers have been found in some of the Swiss pile-dwellings, dating from about the same time.

After a time the apparatus for crushing corn improved, and there was introduced the method of the hand-mill or the push-mill. Such hand-mills are used by the natives of North-west Central Queensland for grinding seeds. The mill consists of a movable stone and a fixed slab on which to press and rub it; both are made of a kind of sandstone. The movable stone is round and about five or six inches in diameter, and it is pressed backwards and forwards with both hands. The slab is irregular in shape but usually somewhat longer than it is broad; as the result of constant use its upper surface becomes flattened. The Akikuya of East Africa use a hand-mill consisting of a lower stone, about twenty-four inches long and sixteen inches wide, and a rubber of slightly smaller dimensions. The lower stone is set so as to be rather higher at one end than the other. Grinding is performed by pushing the upper stone down the slope over the grain. The modern Mexican hand-stone or *muller* is cylindrical like a rolling-pin, though it is not used with a rolling motion. Similar mills are used in Java, in many parts of Africa and in South America.

The result of such a process as that described in the preceding paragraph is to leave the lower stone somewhat concave as the result of rubbing. Since this has been thought to resemble the seat of a saddle, such stones, which have frequently been found among prehistoric surroundings, are called "saddle-stones" or "saddle-querns."

The first clear evidence that we possess of the use of a hand-mill or saddle-quern comes from the pictures upon the walls of an Egyptian tomb, to which reference has already been made in a previous chapter. From this we know that this method of grinding corn was in use during the time of the Old Kingdom, and it is probable that it was introduced at a much earlier date. It is said that it had been in use in Mesopotamia still earlier, but the date of its first introduction into that region is obscure. Examples of this appliance were found in the earliest settlement on the site of Troy, which must go back to 3000 B.C. if not before, and in Italy have been found a number of specimens, which are said to date from the Neolithic Age and certainly go back to the Copper Age. Such methods of grinding corn were in use in most parts of Europe, including the British Isles, in the Bronze Age, and seem to have continued to the close of that period and even later in some places.

Various elaborations of the saddle-quern have evolved in those parts of the world, to which other methods of milling failed to reach. This is specially true of the American continent, which never developed the rotary hand-mill. The most striking of these saddle-querns is the *metata* used in Mexico. This was carved out of a single block of stone, the "saddle" curved and beautifully polished standing upon three legs, all cut out of the same block. Sometimes the "saddle" is decorated at one end with carving, but more often it is quite plain and the

decoration is confined to the legs. The *muller* was a long cylindrical stone, shaped like a rolling-pin, with neatly rounded ends.

By far the most effective method of milling was to make one stone rotate upon another, so that the corn could be ground fine between the upper and the nether mill-stone. Until the introduction of power, this was effected by the rotary hand-mill or quern, the use of which has been at one time or another fairly generally spread over the Old World, though it never reached the American continent.

The rotary-quern consists of two large circular stones with flat surfaces; these surfaces of the two stones are in contact while the mill is working. A wooden peg projects from the centre of the lower stone, and this fits into a hole in a piece of wood fitted across a perforation in the centre of the upper. The grain is ground between the two stones and reaches this place through the perforation in the centre of the upper. The upper stone is made to rotate by hand, and in the more developed examples this is done by means of a handle, consisting of a wooden peg, inserted into a hole not far from its rim. In some cases two such pegs or sticks are inserted, so that two women could be working at the same stone.

This type of quern is still used in North Africa and in many parts of Asia. It has also been used in some parts of Europe in recent times, and as late as 1880 it was in general use in some districts in Scotland, in the Shetlands, the Orkneys and the Hebrides. It was noticed in use in Norway as late as 1897. Some querns have an adjustment for raising and lowering the upper stone, so as to allow of fine or coarse grinding as required.

The method of using the quern is well described by a writer who saw it at work in the Azores not many years ago. "A little further on we came upon two women grinding at the mill. A pair of circular stones, one placed

on the top of the other, are used; the upper fitted with a straight upright handle, the thing being in fact a simple quern. Two women, standing facing one another, catch hold of the handle, one at the top, the other lower down, and they send the upper stone round at a good pace, each exerting her strength when the handle is furthest off from her, and thus pulling to the best advantage." Thus in the Azores quite recently, as in Palestine in the first century of our era, one could see two women grinding at the mill.

The rotary-quern has been found fairly frequently among remains of the Early Iron Age, and it has been suggested that this appliance was first invented some time in the Bronze Age. Of this, however, there seems to be no evidence, and since saddle-querns only and no rotary-querns were found in the settlement at All Cannings Cross in Wiltshire, which dates from the fifth century B.C., it will be safer to assume that its invention occurred at some period during the Early Iron Age, but not necessarily in its earliest phase. It is said that the Romans used rotary-querns as early as the third century B.C., but since the first mention of a mill of this description occurs in a work by Cato, who died in 149 B.C. and probably wrote his great work on agriculture not many years earlier, we cannot be sure that such mills were used before 200 B.C. It is quite possible, however, that they may have been in existence for some time before he wrote.

The rotary-querns of the Early Iron Age in most parts of Europe were small and of simple construction, without any of the elaborations found in later examples. Their use quickly spread all over the Roman empire and beyond, for they have been found in the Early Iron Age "brochs" in the North of Scotland and even in the most distant islands. We cannot be sure, however, that these very northerly examples date from before the landing of

the Romans in Britain. For a long time saddle-querns and rotary-querns were used side by side, even in Italy, where the former were called "trusatile" and the latter "versatile." Cato, in his work on agriculture, to which reference has already been made, speaks of the ass-mill and the trusatile mill, showing that saddle-querns were still in use when rotary-querns had been so far developed that they could be worked by animal power.

The Romans were an ingenious people with a practical turn of mind and great skill in engineering, and they had inherited also from their Etruscan neighbours, who had become incorporated with them, a great power of money-making. Whether or no they invented the rotary-quern is uncertain, but there is no doubt that they developed it into new and more productive forms, and that by about 200 B.C. they had harnessed animal power to do service in the place of woman-power. The stones became larger and flatter, and were often grooved in their surfaces of contact to enable the flour to run out at the sides. Sometimes there were many grooves placed diagonally and at others four deeper grooves radiating from the centre; in fact a great variety of mill-stones developed during the first four centuries of the Christian era. Sometimes the lower stone was made hollow, like a mortar, to hold the upper stone, when a channel cut in the side allowed the flour to escape. Before the close of the first century they had invented a rotary mill, not unlike a dice-box, where the lower stone was conical and the upper stone fitted upon it, but was expanded upon the top, and hollowed into a funnel-shape to receive the corn, while the flour fell out at the bottom all round. In this type of mill, which was often of great size, the lower conical stone was called a *meta*; the upper stone, with its cup-like hollow at the top, was called a *catillus*, and did not rest directly on the *meta*,

but was borne up by a spindle fixed into the lower stone, the top of the spindle resting in an iron socket. Mills of this type have been found among the ruins of Pompeii, which was destroyed by an irruption of Vesuvius in A.D. 79. These mills were not turned by a handle on the top, like those that have been described before, but they had a bar thrust through the centre and were turned in the same way as a capstan. Such mills were, for a time, turned by asses and oxen, and a fragment of a sculpture in marble, preserved at the Vatican, shows a large mill of this type which is being worked by a horse.

The use of animals to turn mills survived in many parts of the world to a late date, and such mills were used in some parts of Germany as late as 1698, while a mill of a similar type was noted late in the nineteenth century at Khiva in Russian Turkistan. Such mills, though little used in Europe after the fourth century of our era, were occasionally set up in opposition to the water-mill of the lord of the manor as late as the sixteenth and seventeenth centuries.

Rotary mill-stones were always of some rough hard stone, usually a coarse sand-stone or a granite, but the Romans generally used a harder rock with a rougher surface. At first they seem to have made their mill-stones of lava, probably derived from Vesuvius, but after their armies had conquered Gaul, they discovered and exploited the famous quarries of Andernach on the Rhine, from which nearly all their mill-stones were afterwards obtained. A number of querns of Andernach stone have been found among the Roman remains in Britain, and part of one such stone was found quite recently in digging the foundations for the new buildings of the Bank of England.

As the Roman Empire grew in size, and many of its

Plate XXXVII. Rotary Querns

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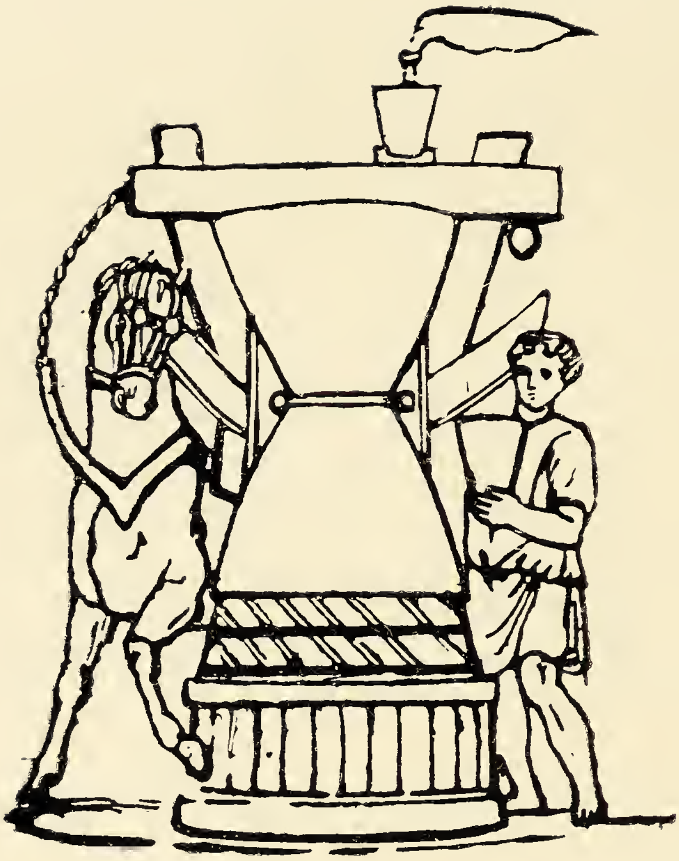

PLATE XXXVIII. A HORSE-MILL

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inhabitants became very rich, there was an abundance of slave labour at their disposal. It seems to have been found more efficient and economical to use these wretched men to work the large rotary-mills than to employ asses or oxen, though doubtless these beasts continued to perform this function on the larger rural estates. Slave labour on the mills was used as early as 200 B.C., but it was during the time of the empire that the greatest number were so employed. The slaves engaged in this work were of the lowest type, and were kept severely to their task, especially at Rome, which, during the empire, imported vast quantities of corn from Egypt, and provided free bread to the bulk of the population, who appear to have been almost permanently unemployed.

The time came, however, when the Roman state was unable any longer to provide free bread and entertainments for their unemployed, for her enemies surrounded her on all sides, her currency had become grossly inflated and her credit was gone. Gone also was the great supply of slaves that had ministered to her needs, and making a virtue of necessity Rome abolished slavery. The mills, no longer worked by slaves but by servants of low degree, became expensive to run, and the Romans looked out for another source of power.

About 20 B.C. Vitruvius, the architect, had described a new water-mill, though it was doubtful whether it was actually erected, but there seems to be no doubt that a similar contrivance was used in the Tiber for raising water. Though the mill had been described as early as 20 B.C., we have no evidence that such an appliance was made or used in Rome much before A.D. 398, when the liberation of slaves had made man-power expensive, though there were three water-mills, worked apparently by an aqueduct, near the Janiculum, about A.D. 361.

The first reference to a water-mill that has been found occurs in an epigram attributed to Antipater of Thessalonica, who flourished about 85 B.C., but it is uncertain whether this epigram was composed by him or by one of two other poets of the same name, who lived a few years later. Strabo, in describing the defeat of Mithradates, King of Pontus, by Pompey, in 65 B.C., mentions that at Cabira the king had enclosed a park, in which he had erected a construction, known as a *Hydraletes*, which is believed to have been a water-mill. This description was written between A.D. 20 and 25.

The next reference that we have to a water-mill is on the River Ruwer, near Treves, early in the fifth century. When Rome was besieged by the Goths in A.D. 536, and the stoppage of the aqueducts rendered it impossible to use the corn-mills, which were then being worked by water brought from a distance, Belisarius erected floating mills in the Tiber to take their place. By this time water-mills had come into operation all over the empire and even beyond its borders. In the sixth century Venantius Fortunatus described a water-mill on the banks of the Moselle, and it is believed that this type of mill had been introduced into Ireland some centuries earlier.

When the water-mill had been introduced into the Roman Empire, its use spread rapidly throughout Europe, and before many centuries were passed such mills had been established at short intervals along every river and stream almost all over the continent. This resulted in a great saving of labour, and the mass of the population, which had hitherto in many parts been living on the hills and uplands, betook themselves to the valley bottoms, which had, up to then, been more sparsely peopled.

The wind-mill was not introduced into Europe until

the Middle Ages, and there appears to be no genuine evidence for its use in England before the year A.D. 1191. Mr. H. P. Vowles has recently suggested that the wind-mill may be traced back to Hellenistic times, for he believes that an appliance described by Heron of Alexandria, who was living about 217 B.C., was a kind of wind-mill. This interpretation of the work of Heron has been disputed, but, as Mr. Vowles has pointed out, an Arab writer, al-Mas'udi, writing early in the tenth century, mentions the existence of wind-mills in Seistan, in Persia. Since, however, the sails of the Persian wind-mills revolved horizontally, it is by no means certain that the European mills, whose sails seem always to have worked vertically, were derived from this source. The early history of the wind-mill is thus obscure though a suggestion has been made that its invention is to be credited to the Chinese.

CHAPTER XIV

THE EVOLUTION OF THE HOUSE

While man was still a hunter he was compelled to be constantly on the move in search of game, and was forced to sleep wherever the chase had led him. As a rule he provided himself with no shelter for the night, but slept in the open or beneath an overhanging cliff, and only took refuge in the depths of a cave during the severe winters that accompanied the Ice Ages. In later days, it is true, some of the more advanced hunters furnished themselves with movable habitations, but this was, in most cases, not long before they had taken to a more advanced mode of life. The wretched food-collectors, with their Mesolithic civilization, or lack of civilization, seem to have been content to erect rude screens or wind-breaks of branches, hastily stuck into the ground, as is the custom to this day among the backward people in Tierra del Fuego. It was, as a rule, only with the advent of agriculture, which necessitated a fixed abode for many months on end, or with the domestication of animals, which somewhat curtailed the necessity for constant wandering, that man found leisure or need for a dwelling, even of the lightest and most movable type.

Many different kinds of houses are found, even at an early date, and it is clear from their forms that they are not all derived from the same model. We must, therefore, take it for granted that the idea of providing a shelter for the night, and one in which various posses-

sions could be stored, had occurred more than once to different men, leading varied types of life in diverse climates, and with different materials at hand with which to build. It would take a whole volume to discuss all these varied styles of architecture and to trace them all to their sources. Here we must be content to deal with three, which ultimately developed into magnificent buildings, the *teepee*, the fly-tent and the log cabin, though passing references will be made to other forms.

The *teepee* is essentially the dwelling of the North American Indians, especially those of the prairies, and was used by them while they still hunted herds of bison over the grassy plains on foot. This type of dwelling has not been noted in the Old World, yet in many parts of Europe, Asia and Africa there are, or were, a number of forms of houses that are clearly derived from it. The *teepee*, as is well known, consists of a number of long poles, as straight and as light as possible, provided that they do not bend. These are tied together at one end by means of thongs of skin or raw-hide, while the other ends are spread out till they form a tall and narrow cone. Over this framework are cast a few hides of animals, nowadays roughly tanned, but formerly only dried in the sun, and thus is formed a small, though rather high, circular tent, in which a fire could be lit, and in which a small group of people could sit with their backs to the outside.

The great advantage of the *teepee* was that it was light and easily carried, and so it was suitable for a hunting people who had ever to be on the move. Each stick could be carried separately, while the skins that covered it could be conveyed by others, and it could be set up quickly when the band decided to camp for the night. Its limitations were considerable. If the posts were set too far apart they would spread out under the weight

of the skins and the whole structure would collapse. This restricted the floor-space to such an extent that it was impossible to lie full length under cover, and while sitting round the edge the back had to be bent forward to an uncomfortable extent. Still it met the needs of the nomad hunters and is still in use in North America, or was so about twenty-five years ago, when the author saw an encampment of this kind on the Jocko River, in the Rocky Mountains.

Though the origin of the *teepee* is unknown, dwellings that are evidently derived from it have a wide distribution throughout the Old World. We may, however, suspect that it arose, either during the Upper Palæolithic Age or early in the Mesolithic Age, somewhere in North Africa, in the grasslands that then occupied the greater part of what is now the Sahara Desert. We have reason for believing that between 7000 and 6000 B.C., as the desert area was increasing, there was a great exodus from this region, and the people spread out in every direction, carrying with them the habit of making implements for the chase out of small and finely worked fragments of flint set in wooden hafts. These people wandered over all parts of Europe that were free from forest and on into Turkistan and perhaps Siberia, they crossed the Nile and the Red Sea and passed across Mesopotamia and Persia to India and Ceylon, and they traversed the grass and scrublands of East Africa until they reached the Cape. In these directions, we must imagine, they carried the *teepee* while some of them took it across Siberia and they, or others who had borrowed the idea from them, crossed the Behring Straits and brought this kind of dwelling into North America, where it has remained unchanged to our own time.

As, however, some of these people took to the practice of grain growing, or became possessed of domesticated

animals, they came to be settled permanently near their fields or else wandered only occasionally over a more restricted area. Thus they were able to provide themselves with more permanent and comfortable dwellings. They discovered that if they used more poles, set wider apart, they could make an abode in which they could lie full length when they slept. Further, if they used thin poles that would bend, they could make the sides perpendicular for some little way up, so that they could sit upright against the wall of the hut. This could be effected by twining withies, or other easily bended sticks, between the original poles or ribs, thus producing a form of wattle or wicker-work. Such wattled huts would take the form of a beehive or semi-spherical structure, and it would be possible to keep out the rain either by daubing the whole surface with mud or clay, or by thatching it right down to the ground with dry grass or rushes. Such huts are still used by many native tribes in Africa to this day, and similar huts, thatched with grass or rushes, may still be seen in many parts of the Balkan peninsula.

We have seen, however, that soon after the first use of the *teepee* and its derivatives the Sahara was becoming a desert, and in many places near its margin it would have been impossible to find the pliable poles needed for the ribs of such a hut, or the more pliable twigs needed to make the wattle-work. In one area, in Tripoli, the inhabitants met the difficulty in this way. Finding themselves in a region in which slabs of stone were lying about in plenty, they built circular houses with thick walls out of the stones, then, after these had reached a height of three or four feet, they placed a long stone over the space they had left for an entrance, supporting this partly on two great stones set upright on either side of the doorway, and then they were ready for the roof. Having no timber for the rafters or rushes for

thatch, they built the further courses of the walls projecting a few inches inwards, each course being laid a little more inwards than the last, and continued this process until only a small hole was left at the top, and this they closed with a large stone.

Remains of circular stone huts of this type were found nearly twenty years ago by Mr. Oric Bates on "Seal Island," in the Gulf of Bombah, on the north coast of Africa, about four hundred and fifty miles west of Alexandria and in the province of Cyrenaica. These huts were of a great but uncertain antiquity, and were believed by Bates to be the remains of the houses of the early Libyans. Similar huts, believed to be also of Libyan origin, were found by the same investigator in Nubia, and appeared to date from some time between the sixth and the eighteenth dynasties. Similar structures, but used as tombs, were found to the west of the Sahara Desert, in the Sud Oranais, by Messrs. Randall MacIver and Wilkin, and this type of house continued in use in North Africa until it was occupied by the Romans, who called them *mapalia*, and even as late as the time of St. Jerome, who died in A.D. 420, and who compared them with ovens. Thus such circular huts of stone, roofed with false domes, seem to have been in use in North Africa from 3500 B.C., or perhaps earlier, until well after the beginning of the Christian era. Mr. O. G. S. Crawford has recently informed the present writer that he has seen such circular stone huts, but with thatched roofs, in use in the extreme south of Tunisia.

It was about 3400 B.C., so Sir Arthur Evans thinks, that some Libyan people, having been conquered by tribes from South Egypt under Menes, who first made Egypt a single kingdom, left their country and sailed for Crete, where they landed in the south of the island near the Mesara Plain. These seem to have introduced into the

a. Teepee

b. Dome-shaped wattle hut

Plate XXXIX. Teepee and Dome-shaped Wattle Hut

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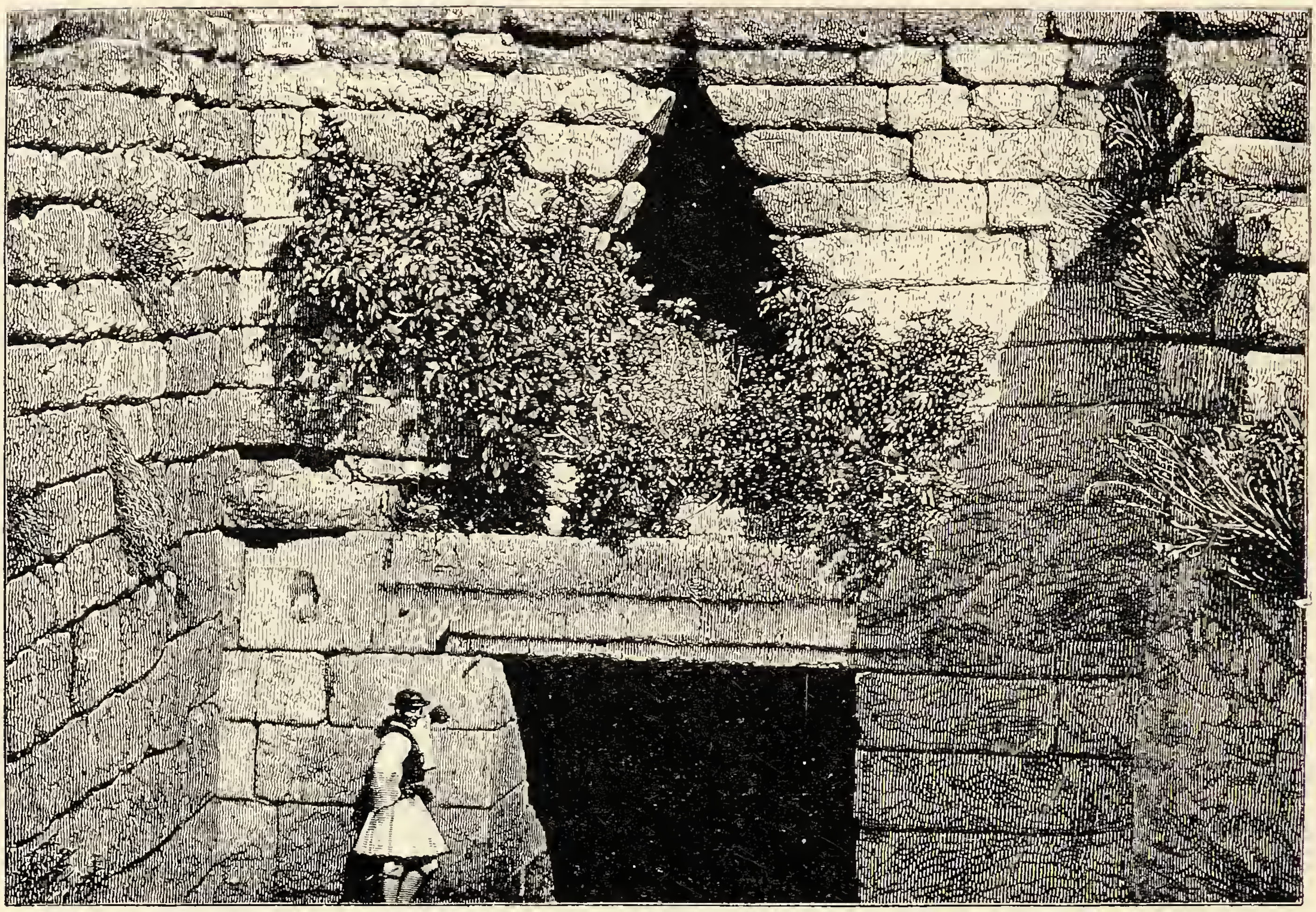

a. Entrance to the Treasury of Atreus, Mycenæ

[*Photo, E.N.A.*

b. The Mosque of Santa Sophia, Constantinople

Plate XL. Treasury of Atreus and Santa Sophia

island the stone huts with false-domed or corbelled roofs, but soon discarded them as dwellings, though they continued to use them as tombs. Many such corbelled structures are still to be found on the Mesara Plain and elsewhere in Crete, where they were in use as tombs until after 2000 B.C.; similar structures are still erected in the mountains, especially on the slopes of Mount Ida, and these are used as dairies.

About 1600 B.C., or perhaps rather earlier, the idea of erecting such tombs was introduced on to the mainland of Greece, where several have been found, especially in the neighbourhood of Mycenae and Orchomenos. These were not built in the open, but in the sides of the hills and covered over with earth, entrance to them being achieved by means of a long, stone-lined passage, called a *dromos*. The most famous of these was known to the ancient Greeks as the Treasury of Atreus and is still called by that name. It is a large vault, with a beautifully corbelled roof in the form of a dome, and its entrance was flanked by two decorated columns, parts of which are in the British Museum.

The Cretans, as is well known, were great traders, especially during Middle Minoan and the early part of Late Minoan days, though the sea-power of the island received a severe blow at the time of the destruction of the Palace of Knossos, about 1400 B.C. The trade of Crete was mainly to the west, to South Italy, Sicily, Sardinia, Spain and Portugal, and in each of these regions we find evidence that the corbelled, dome-shaped tomb was introduced. In South Italy no very clear ancient examples have been noted, but in some of the villages of Apulia, the heel of Italy, there are a number of curious buildings, known as *truddhi*, of dry stone walling and corbelled roofs, exactly resembling the corbelled tombs of the Mesara Plain. In South-east

Sicily the tombs are always cut in the soft limestone rock, but here the dome-shape of the roof shows that they have received inspiration from the same source. In Sardinia there are low towers, called *nuraghi*, constructed in the same way, while in Spain and Portugal there are corbelled tombs, like small and rough editions of the Treasury of Atreus, covered with a large mound of earth and approached by a long gallery or *dromos*.

During the centuries immediately preceding and following 2000 B.C. there was much sea traffic along the Atlantic coast of Europe from Spain and Portugal to Brittany, Ireland, Wales, the West of England and Scotland, and even to Denmark. The idea of the corbelled tomb travelled along this route, but, since corbelling is a difficult art, the tombs were usually made of a number of large stones set on end and covered by a large capstone. Such tombs are usually known as *dolmens*, and the type of architecture is called *megalithic*. In almost every region in which megalithic buildings are to be seen we find also the presence of beehive huts, small dwellings made after the model of the stone huts of Libya.

The false-domed structure seems to have been carried somehow into Northern Asia, or else developed there from the dome-like wattled hut. Many of the primitive tribes in Siberia live in habitations not unlike those of the early Libyans, but made of clods of earth instead of stones. Since the winters are very cold in Siberia the people use this earthen dome only for a roof, and, since they cannot build earthen walls of sufficient strength to support so heavy a superstructure, they sink circular holes in the ground, which are roofed with this dome-like structure. This practice has a wide distribution over Northern Asia, and has been carried across Behring Straits to North America, where some

of the natives in British Columbia formerly constructed such dwellings, remains of which may still be seen and are known as *kekwilley holes*. As the soil was dry and useless for building a corbelled roof, the superstructure was made of logs, built in the shape of a dome, and these were covered by sticks, grass and mud. The same style of architecture was carried also still farther north, where the Eskimo still occasionally build their *igloos* in this style out of large masses of frozen snow.

These dome-like structures, as has been stated, were not true domes, for the courses were laid horizontally, each projecting inwards more than the one below it. A true dome, like a true arch, has its courses tilted towards a centre. It is always said that the earliest true dome is the Pantheon at Rome, erected about 100 B.C. How the Romans arrived at this idea is uncertain, but we may suspect that, like the arch and the barrel-vault, they had derived it from their neighbours the Etruscans. This mysterious people are said to have arrived in Italy many centuries earlier from Asia Minor, but so far no early domed or corbelled structure has been discovered in that country.

There is some reason for believing that at a quite early date domed structures of brick were made by the early people in Mesopotamia, but whether they had received the idea originally from North Africa cannot yet be determined. At a fairly early date the dome was used by the Persians, who were the first to discover how to place it upon four pillars, and it is probably from these people that the idea spread over the eastern Mediterranean, where we have fine examples in Constantinople, the earliest of which is the little church, now a mosque, usually known as the little Santa Sophia, and which was an experiment made before the erection of the great cathedral of that name. The Mosque of

Omar in Jerusalem is another early example, and during the centuries that followed many domes were erected in Byzantine churches and Mohammedan mosques. From the East the idea was again carried to the West, where we have the dome of St. Mark's at Venice and in the Duomo at Florence in the heart of the Etruscan country. Then we have Michelangelo's great dome at St. Peter's in Rome, and a century later the dome of St. Paul's, in London. Thus from the humble *teepee* of the hunter has been derived one of the noblest ideas of modern architecture.

Another form of tent, convenient and easily carried, is that known usually as the fly-tent. This is of very simple construction, consisting of a light straight rod, about six to eight feet long, resting about five or six feet above the ground on two supports, one at either end. The supports may be of two kinds. The simplest is a similar rod, driven into the ground, with a fork on the upper end upon which the longer rod or ridge-pole rests. An alternative method is to fix two straight rods obliquely into the ground, so that the upper ends just cross, and to tie them at their junction with a strip of raw-hide. When a similar pair has been erected at the required distance, the ridge-pole is placed upon both pairs and tied into position, but then a stay rope is required at each end to prevent the structure from collapsing. Over the ridge-pole are cast a few hides, to which thongs have been attached, and these are pegged down to the ground. Thus a tent is erected, about six or eight feet long, about six feet wide and about five or six feet high in the centre, just like a gabled roof resting upon the ground. It is important in this tent that the rods, though light, should be quite rigid.

Judging by the distribution of dwellings based upon this kind of tent, we must imagine that it was first used

by the herders of cattle upon the Russo-Turkistan steppe, though from the nature of the case we have no direct evidence that this was the case. We have, however, an earthenware model of a more permanent variant of this type of abode, which was found in a *kurgan,* or burial mound, at Ulski, in the Kuban district of South Russia. This model suggests that for winter quarters the herdsmen of South Russia used the second method for providing the support for their ridge-poles, but that they were not content with two pairs of rods but used a number, and employed pliable rods for this purpose, just as some of the African natives used pliable rods for making their mud-covered dome-shaped huts. It is probable that in South Russia as in Central Africa, wattle-work was used for the sides and roof of the dwelling and that this, too, was covered with clay or mud. The entrance seems to have been effected by means of windows left at one side and one end. This form of dwelling, like its African counterpart, made it possible to sit with one's back to the wall without leaning forward.

After about 2600 B.C. many of the cattle-men departed from the Russian steppe and spread in various directions. Most of these settled in various parts of Central Europe and the Balkan peninsula, among agricultural people who had already evolved a more permanent type of dwelling. Some, however, passed to the coast of the Baltic Sea, and settled around its shores, where they found only some primitive people, living in a backward Mesolithic condition, whose only form of shelter seems to have been wind-breaks to keep off the worst storms. The cattle-men had come to a land where pine trees flourished and where this timber was plentiful, and they set to work to make more permanent habitations out of the material that they found ready to hand.

Soon after their arrival on the shores of the Baltic

Sea the herdsmen learnt the practice of agriculture from those who had come by the coastal route from Spain and Portugal, and, since they now depended partly on their crops and partly by fishing in home waters, they needed more permanent abodes than had been possible during their nomad life upon the grasslands. The houses that they constructed were built on the same model as their tents, but of heavier materials and of larger size. Trunks of pine trees now took the place of slender poles, while split trunks, laid upon the ridge-pole, with one end on the ground, and covered with thatch, took the place of the former skin covering.

Our Saxon ancestors, descendants of these early Baltic settlers, were not building houses in advance of this type when they first arrived here in the fifth and sixth centuries of our era, and the subsequent evolution of this type of dwelling can be well studied in England, though many interesting examples of the kind are to be seen in Holland, North Germany and the Scandinavian countries. The earliest Saxon houses that we know of were excavated in 1921 by Mr. E. Thurlow Leeds at Sutton Courtenay, in Berkshire, and here he found that the ridge-pole was invariably supported by a single pole at either end. From this rafters had been placed, either close together or at intervals, with their ends resting on the ground, and the whole had probably been covered with thatch.

The other method of supporting the ends of the ridge-pole must also have been in use, though instances of it were not discovered at Sutton Courtenay. Very old houses are, or were until lately, in existence, the ridge-poles of which were supported by pairs of posts, crossing one another at the top. These, which were usually curved and not straight, thus reminding us of the hut from Ulski, were known as "cruks," and several such

a. A Fly-tent

b. Model of Ulski tent

Plate XLI. Fly-tent and Ulski Tent

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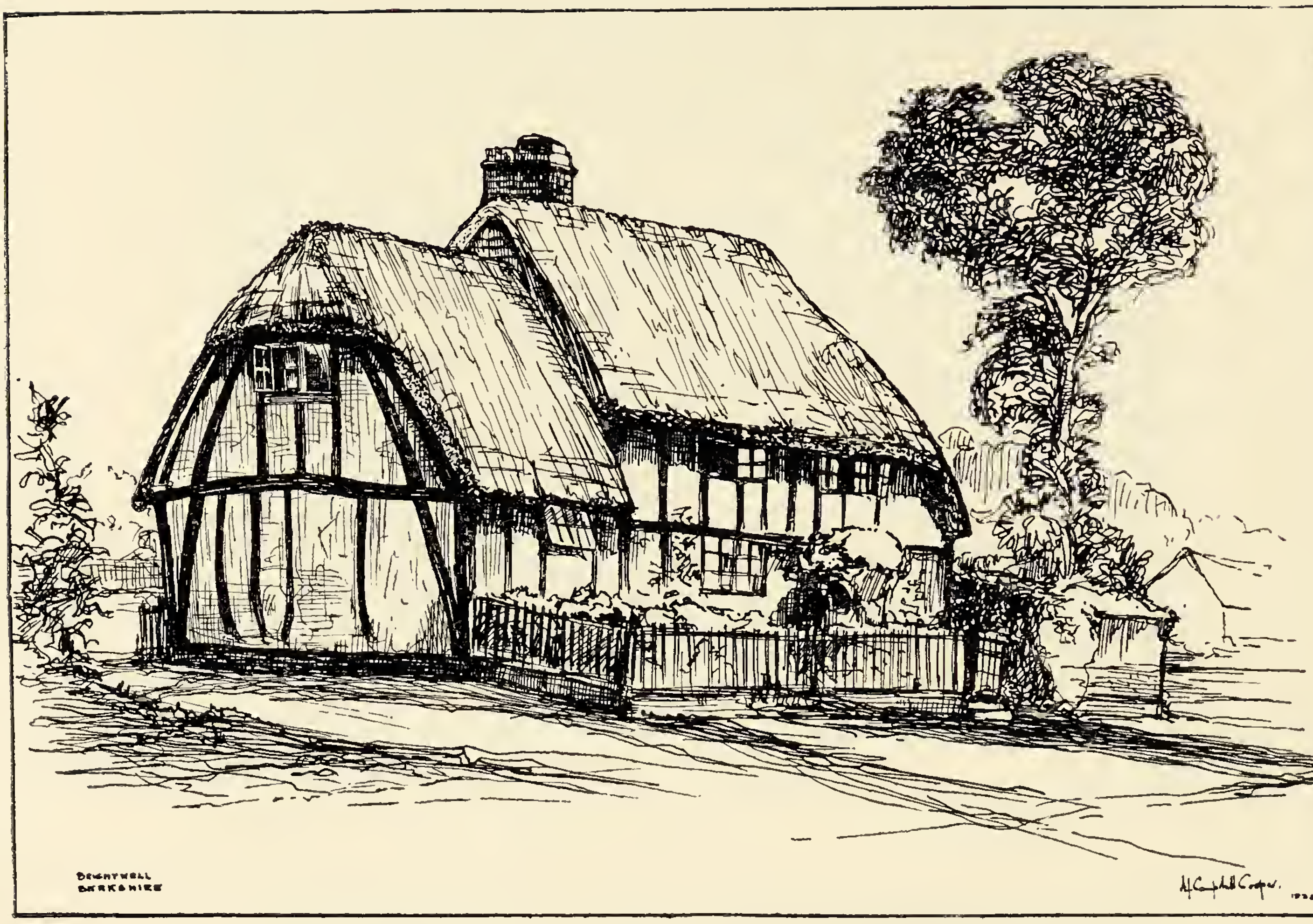
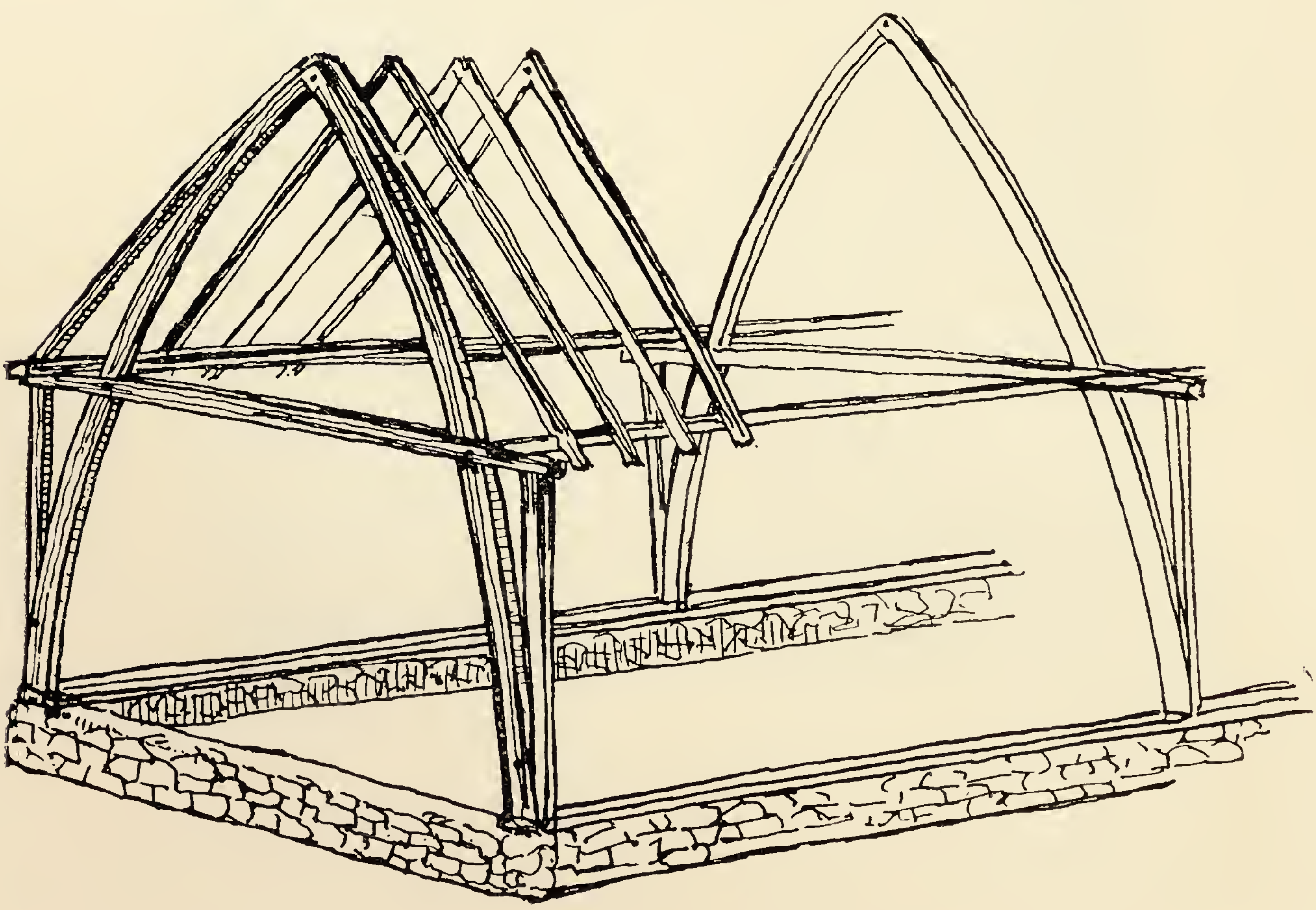


a. House with cruks at Brightwell, Berks.
Drawn by A. J. Campbell Cooper



b. Diagram of house with cruks
Drawn by A. J. Campbell Cooper

Plate XLII. A House with Cruks

pairs ran down the building, supporting the ridge-pole, and the intervening spaces were filled with wattle-work, covered with clay or plaster for some way up and thatched with straw above. One such house, quite unspoiled, was to be seen a few years ago at Winwick, near Warrington.

As the house became larger and the rafters from the ground to the ridge-pole longer, it became necessary to give the latter some support in the middle to prevent them from sagging. This was done by inserting another long pole or tree trunk known as a purlin, and stout posts were driven in at either end of this to support it, and sometimes intermediate posts at intervals, thus dividing the eaves into a number of compartments. From the purlins cloths or skins were hung to screen off the parts behind them for sleeping apartments, and in early Welsh houses, where the family dwelt together until there were five generations under the same roof, each married couple with their children occupied one of these compartments, which were known as *gweliau*. By degrees the spaces below the purlins were boarded instead of being hung with curtains, and thus there was a great central hall with a number of small rooms on either side. Then the house became higher, and instead of the roof falling from the ridge-pole to the ground, it stopped short at the purlins, which became what are now called the wall-plates. The lean-to side rooms were, however, still necessary, but did not require the additional height. They became only lean-to buildings against the walls, and a clear space of wall was left above them, with *louvre* ventilators to let out the smoke from the central hearth, and ultimately to be windows. It was not until about the thirteenth century that a second story was sometimes added over the end of the hall, for the benefit of the owner of the house and his wife, when the kitchen and servants' offices were placed beneath it.

A farm-house on these lines may be seen in the open-air Folk-Museum, at Arnhem, in Holland, and a few such houses or variants of them still survive in the Baltic region. It will have been noticed that this style of house consists primarily of a long central hall with lean-to bedrooms on either side, and this reminds us of the nave and aisles of our larger churches, while the louvre ventilators in the blank upper walls have become the *clerestory* windows. When the great cathedrals arose with nave and four aisles, this division became repeated, so that there were three members, the ground floor, the *triforium* and the *clerestory*. Thus the fly-tent developed into the Saxon and the medieval house and laid down the main lines of the Gothic cathedral.

The two types of dwelling that we have described hitherto began as tents for hunting or pastoral peoples and developed ultimately into the dome and the Gothic cathedral. The third type, the log cabin, was only possible for a people of sedentary habits, and must have arisen first of all in an agricultural community. Here again we have no direct evidence of its earliest form, but, since it is found in a very primitive style in the Swiss pile-dwellings, and we find traces of its early existence in Asia Minor, whence agriculture was brought to Central Europe, we may reasonably conjecture that it arose somewhere in South-west Asia, where pine trees were to be found, that is to say, somewhere in Asia Minor or Armenia.

The log cabin is like a rectangular box made of straight logs piled on one another, first two long ones for the sides, then two short ones for the ends, then repeating the process like children playing with a box of wooden bricks. The roof is formed by placing a rather thicker trunk in the centre, resting on the two ends, which are left higher than the sides, and then placing a number of

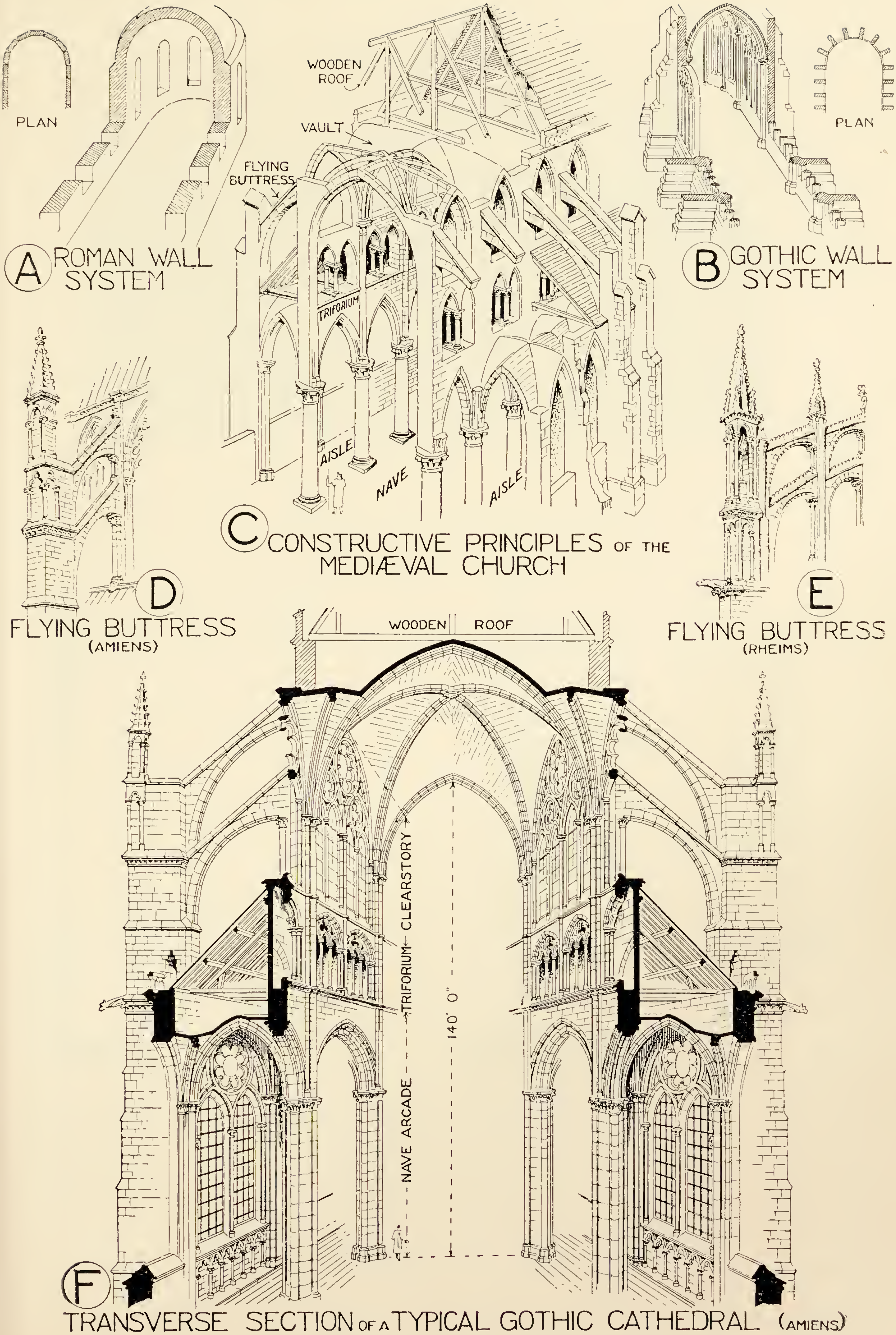
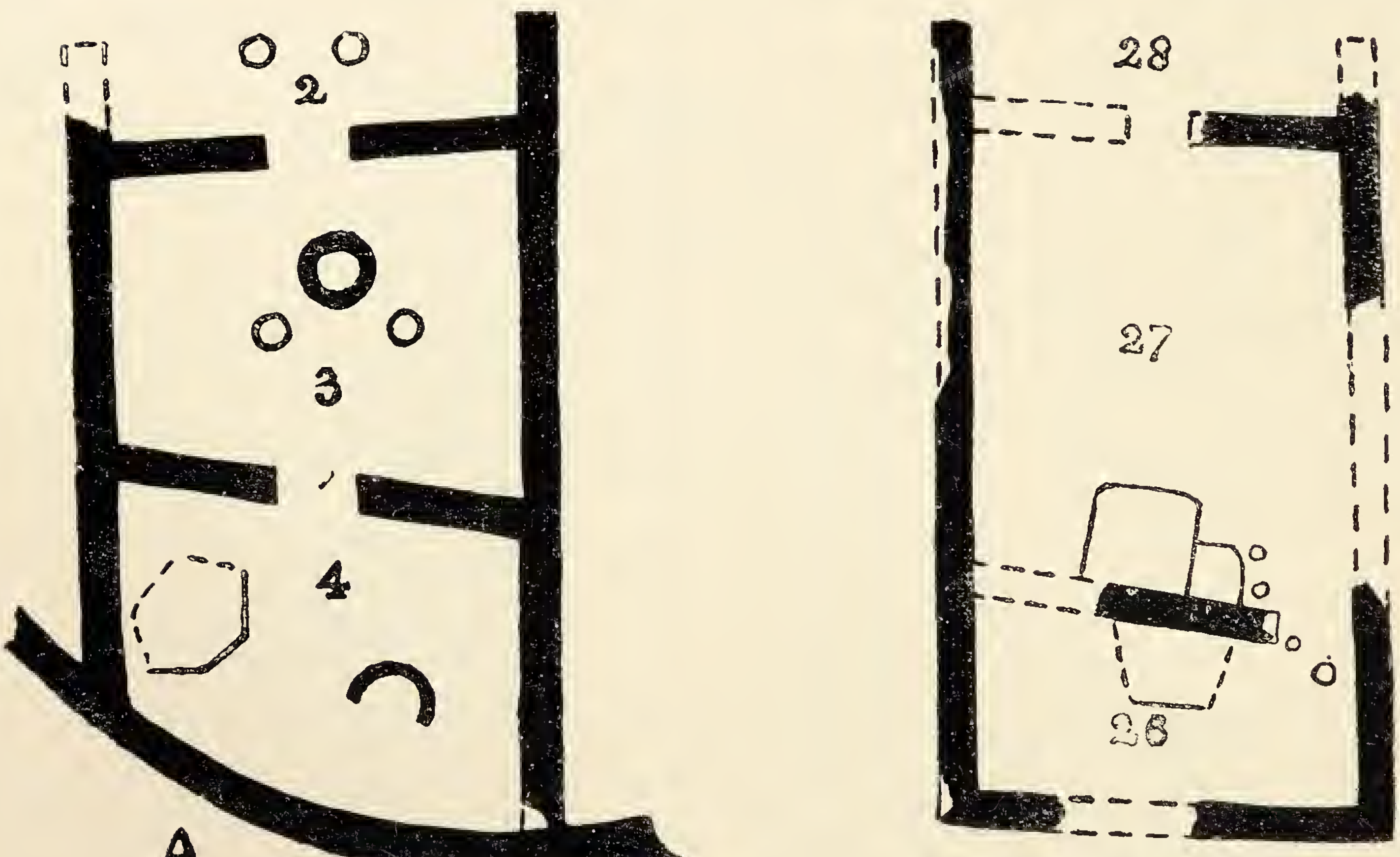


Plate XLIII. Section of a Gothic Cathedral

a. A log cabin



b. Plan of a Megaron

PLATE XLIV. LOG CABIN AND MEGARON

shorter and smaller logs, sometimes split, from the central log or ridge to the sides, often leaving overhanging eaves, and covering the whole with leaves or grass and a final thick coating of mud.

Such a cabin, however, leaves much to be desired, since the logs are separated from one another by the thickness of those laid across them. As men grew cleverer in the use of their stone axes, they cut a hollow on both sides of each log towards the end, where it rested upon the log beneath and where it received that resting upon it. At first a doorway was a difficulty, though windows were unnecessary, since ample daylight could enter between the logs. It seems probable that at first entry was made by digging a passage under one of the bottom logs, but in time, as tools improved, a low doorway was made at one end, and, when the building had grown large enough to hold men and beasts, a log partition was made across it and a door was opened at each end. Log cabins such as that just described have been found among the pile-dwellings that were erected on the marshes near the lakes in Switzerland, Bavaria and Austria.

After a time, when metal axes had been long in use, the corner joints became more elaborately made, so as to enable the logs to lie more closely together; this was done by a method known as hog-backing. On the top of each log, where another was to rest, the log was hacked away so as to form a sharp ridge, while a deep V-shaped cut was made in the log that was to follow. When this was well done each log lay closely on its fellow, and the small interstices that were left were filled in with mud, so that all rain and draught was excluded. This shut out the light also, but it was now possible to make windows, and these were usually cut on either side of the front door, and sometimes over it.

A particular type of log cabin seems to have grown up in Asia Minor, whence it was carried to some parts of Europe. In this type the side logs were continued for some feet beyond the corners on the front end of the house and the roof-tree also, so that a covered porch was formed. Since the roof of the porch was rather unstable, a beam was thrown across between the top logs, and the space between this and the roof filled in with woodwork. Since this beam tended to sag in large buildings, two or more trunks were placed vertically to support it, thus becoming pillars opposite either side of the doorway. Such a porched house is known as a *megaron*, and it was in houses of this type that the heroes of the Trojan War dwelt when at home, and the *megaron* of Odysseus is well described in the Odyssey.

Where timber was scarce the *megaron* was built of stone, and the foundations of several such buildings were found on the site of the second City of Troy, which was destroyed about 1900 B.C., seven hundred years before its successor was attacked by the Achaean forces under Agamemnon. In a city in the Island of Lesbos, which dates from soon after the foundation of the second City of Troy, about 2600 B.C., and belongs to the same civilization, Miss Winifred Lamb, in the summer of 1931, found the foundations of a large house closely resembling a *megaron*. The *megaron*, either in wood or in stone, was introduced at an early date into Europe, and one has been found at Erösd, in Transylvania, which must date from about the same time as that recently found in Lesbos.

In Central Europe the log cabin grew larger and more elaborate, though usually one half was kept for the inhabitants and the other for their beasts. In the course of time the larger farm houses, especially in the Inn Valley, were built of stone, and often of three stories,

but the arrangement remained substantially the same. In front was the door with one or two windows on each side, above a row of windows, usually with balconies, and a third row above, just below the roof, which still retained its low gable. The back half of the bottom floor was allotted to the beasts, the first floor to the hay, which was driven up to this level along a steep stone ramp, and the top floor to the waggons and agricultural machines, which were hauled up by ropes and pulleys. In the smarter houses the stable half was omitted, and the house became almost square. Still it was and is characterised by its low pitched roof, its central door and evenly spaced windows on the gable front, its overhanging eaves and its wealth of balconies and elaborate wood-work. Such is the Swiss chalet to-day, one of the direct descendants of the primitive log cabin.

The log cabin has, however, another descendant. We have seen that in the *megaron* there was a porch at one end, sometimes supported by two central columns. Sometimes there was a porch at both ends, especially when the building was divided into two rooms as it was in Central Europe. Also the sides were not always prolonged to support the porch roof, which was held up by a series of wooden posts. Sometimes again the roof timbers were allowed to overhang so far on the sides that a row of wooden posts was necessary to support them, so that there developed a long rectangular building, divided into two rooms, with a very low-pitched gable roof, prolonged beyond the building at both ends and with overhanging eaves; the prolonged ends and eaves were supported by a row of columns. When this was translated into stone and marble, as it was in the sixth century B.C., if not before, it became the well-known Doric temple, the finest example of which is the Parthenon, on the Acropolis, at Athens.

These are only three of the many types of primitive dwellings that arose to shelter early man, but perhaps the three most important, since they led by slow degrees to the dome, the Gothic cathedral and the Greek temple. In Egypt the earliest people merely set up mats on sticks, more to give shade from the sun than protection from the weather, and these rectangular shelters were later on replaced by simple structures of sun-dried brick. The antediluvian inhabitants of Mesopotamia seem also to have lived in huts made of mats of platted rush, but here, too, these simple dwellings soon gave way to brick buildings. The evolution of the house has not, as yet, been well worked out in either of these lands. In Crete the Neolithic houses were simple rectangular stone structures with two small rooms, built on what is known in the west of Scotland as the but-and-ben plan. The origin of this type has not yet been explained, but it developed into complicated structures such as the palaces of Knossos and Phaistos, with their light-wells and long corridors. The forms of houses throughout the world are numerous and varied, and we must be content to have followed the evolution of a few of the most important.

a. Swiss chalet [*Photo, E.N.A.*

b. The Parthenon at Athens (restored)

PLATE XLV. SWISS CHALET AND PARTHENON

Plate XLVI. An Elementeitan Pot

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CHAPTER XV

THE POTTER'S ART

When man had discovered how to grow grain and had thereby achieved a certain supply of food, it no longer became necessary for him to wander far afield in search of game, and it was possible for him to have a fixed abode. Having a house he needed to furnish it, and vessels were needed to hold articles of food and drink. For some time before, as we have seen, he had made use of gourds and such natural receptacles, and had made baskets and leather bags; now he needed something that would not only hold water but would withstand the action of fire. So it is that, whenever a group of men passed from the condition of the hunter to that of the grain grower, this change is always accompanied by the manufacture and use of pottery.

At one time it was believed that some groups of men had made and used pottery in the Mesolithic Age, at any rate such groups as were food-collectors and had no necessity to wander for great distances, and were thus able to have fixed abodes. In support of this view it was pointed out that fragments of rough pottery had been found in the shell-mounds of Denmark, where the people had been living in a Mesolithic condition. Later on it was discovered that certain settlements in the northern Baltic, whose inhabitants were living in a truly Mesolithic condition, had lasted on long into the Neolithic Age and perhaps even into the Bronze Age. It was suggested, therefore, that some of the shell-mounds

of Denmark were still being accumulated after the knowledge of agriculture had been introduced into that country by a fresh people, who had arrived by sea, and were the builders of those great tombs of large unhewn stones, known as the passage graves. These people, it is now generally agreed, had spread along the west and north-west coasts of Europe and had come originally from Spain and Portugal. It was pointed out that the shapes of the pots found in the shell-mounds closely resembles some found at El Garcia in Spain, and the belief arose that pottery did not anywhere precede the cultivation of grain, though it might occasionally have been borrowed by backward peoples still living in a Mesolithic condition by the side of others who had advanced into a true Neolithic phase.

This belief has received a severe shock from news that has recently reached us from East Africa. For some years past Mr. L. S. B. Leakey has been exploring a number of prehistoric sites in Kenya, where he has found the remains of a number of industries, closely resembling, though not identical with, most of those recognised in early times in Europe. Thus he has two industries comparable with that of Chelles, one like that of St. Acheul, two reminiscent of that of Le Moustier and three that are very similar to that of Aurignac; there are also at least two that are evidently Mesolithic, and one of these, the Elementeitan, contains small flint implements identical with those that have been found radiating out from the Sahara region in the Mesolithic Age. These industries follow one another in much the same sequence as the corresponding industries in Europe, except that the Le Moustier and Aurignac counterparts are contemporary, while nothing has been found in Kenya to correspond to the European industries of Solutré and La Madeleine.

Mr. Leakey has warned us that these industries are not quite identical with those known from Europe, and that they may not be strictly contemporary. Nevertheless the geological evidence indicating the nature of the climate when these industries were in vogue, warns us that their dates cannot be very different from those of their European counterparts, except that the Aurignac industry of Kenya, like that of North Europe, lasted down to the end of the phase of La Madeleine, and may have continued in use somewhat later.

Now among the remains of the Elementeitan industry Leakey has found a considerable number of fragments of pottery, and these, too, of a not very primitive type, for many have well-made rims and some are decorated. As we have seen, Mesolithic conditions in the North Baltic lasted very late and even in Denmark may have come down very nearly to 2000 B.C.; in the south of France, too, a microlithic flint implement of Mesolithic type was found in a cave in association with pottery of the dolmen type, which must date only a century or two, at the earliest, before 2000 B.C. There would be nothing surprising, therefore, if Mesolithic culture lasted as late or even later in Kenya. When we realise that the Badarian culture in Egypt goes back to 5000 B.C., and that the still earlier Tasians had well-made pottery, we have at least three thousand years in which the idea of making pottery could have filtered through from the Lower Nile up to its source and beyond. It is, then, quite possible that the Elementeitan pottery, like that found in the Danish shell-mounds, is a case in which a people, in a food-collecting or Mesolithic condition, had borrowed, perhaps indirectly in this case, the idea of making pottery from one that had already discovered or learned the art of agriculture.

Mr. Leakey made also another and much more startling

discovery. He was excavating deposits in Gamble's Cave II, yielding remains of the Upper Kenya Aurignac industry, when on February 12th, 1929, he came upon a piece of rough pottery, and on August 27th that year, Professor Fleure, who was visiting the excavations, found another piece. Other small fragments were found, but in these cases it was uncertain whether they came from this or from a later deposit. Still there are two fragments that have come direct from an undisturbed layer in the cave yielding only remains of the Upper Kenya Aurignac industry. This is a very startling discovery, for this is the first time that anything like pottery has been discovered in an undoubted Palæolithic layer, which must be looked upon as the equivalent in time of the La Madeleine phase in Europe, though conceivably slightly later in date. It would be very hazardous, however, to suggest that this deposit was laid down later or even as late as the time in which the Tasian industry flourished in Egypt.

The first piece found is thick and very rough and so poor in quality that as soon as it was placed in water for the purpose of being cleaned it began to disintegrate and had to be removed without delay. It is about four inches long, two and a half inches wide, and less than half an inch thick. From the photograph it appears to be quite flat, and it gives no idea of the shape of the pot of which it had formed part, if, indeed, it was ever part of a pot. The second piece, found in August, is decidedly more instructive. It is about the same size as the other piece, and according to Leakey is "part of a lump of clay which had been plastered on to the inside of a basket."

From its very simplicity the first piece tells us little or nothing. There is nothing to indicate that it formed part of a pot, and it may well have been a lump of clay, flattened for some purpose or for none, and then cast

PLATE XLVII. KENYA AURIGNACIAN POTTERY

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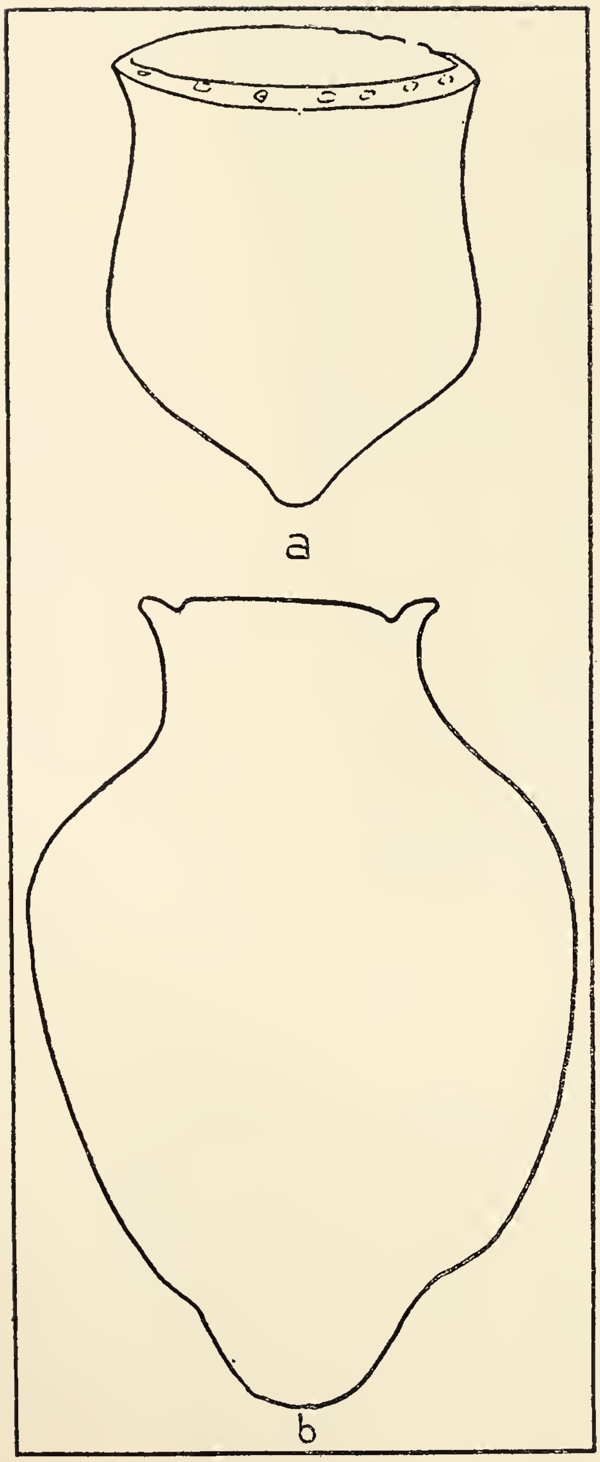
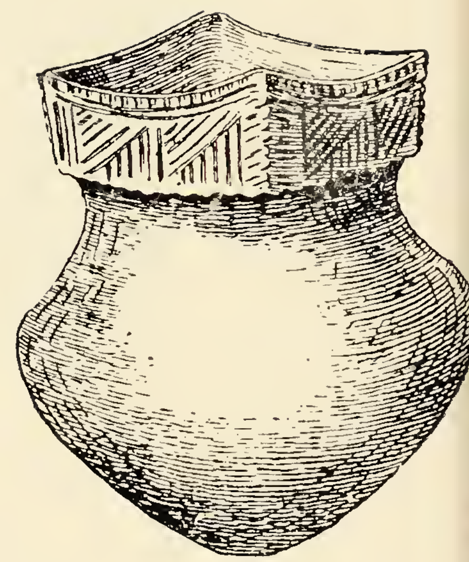
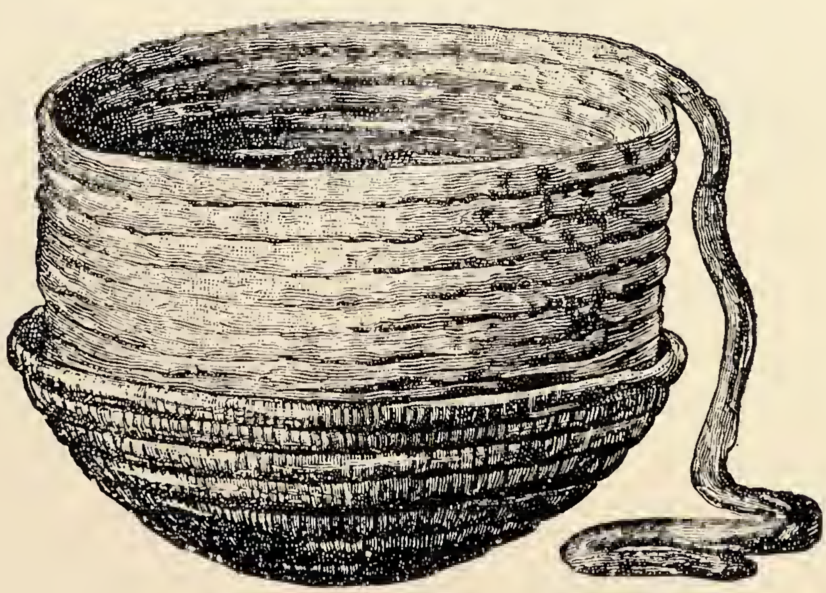


a. Shell-mound pot
b. Pot from El Garcia



c. Modelled pot



d. Coiled pot

Plate XLVIII. Pots from Shell-mounds and El Garcia: Modelled and Coiled Pots

into the camp-fire, where it became baked into pottery. The other, however, is more instructive. It shows us that, as we have already suspected, the people of the Upper Palæolithic Age made and used baskets. It further shows us that at least on one occasion, and very likely as a general rule, they lined some of their baskets with clay when they wished them to hold water. It further shows us that once, and perhaps frequently, such a basketful of water was placed on the fire, when the clay lining became converted into pottery. Thus in a sense we have evidence that the hunting folk of the Upper Palæolithic Age made and used pottery, but this discovery does nothing to prove to us that they made pots. This is a vital distinction, and we may still believe that pots were not made before the discovery of agriculture, though people ignorant of grain growing sometimes learned from others how to make pots and still earlier folk unwittingly made pottery but not pots.

Pottery is made of clay that is then burned or baked in a fire. As a rule the clay to be used is sought with care, so as to find the most suitable variety, and it is then tempered with sand, pulverised potsherds or burnt shells. When the pot has been made it is left for a time to dry in the sun, that the greater part of the water contained in it may evaporate, and then it is baked in an open fire, sometimes covered over with clods of earth, or, in more advanced societies, in a kiln built for that purpose.

There are two chief ways of fashioning a pot: modelling and coiling. A third method, known as coating or moulding, is seldom employed by primitive peoples. In modelling a lump of clay is worked into the form of the pot with the hands. Sometimes the base is formed inside a shallow tray, but more often the clay is kneaded and made into a round lump, then a hole is made in the middle: this hole is enlarged with the hand so that the pot expands

until the required size and thinness of the walls has been attained. In the coiling method long strips of clay are prepared and are wound in a continuous spiral until the desired form has been reached. Then the coils are united by pressure and the surfaces smoothed out by the fingers or by some simple tool. Hand-made pottery of these types is made by most primitive people, and it was not until relatively late times that the appliance known as the wheel was introduced, and this never reached the New World before the Spanish conquest.

Many primitive potters were anxious to make pots with a smooth glassy surface. To effect this they made their pots with rounded bases, then, placing one hand inside, they turned the pot slowly, with its rounded base resting on a flat stone, while they burnished the surface with a small hard flat-sided pebble. Since early houses had no floors but the soft earth or sand, a round-bottomed pot would stand up quite well. As better houses arose, usually in the Bronze Age, with floors of wood or stone, flat-bottomed pots became a necessity. It was then impossible to turn them for the purpose of burnishing, so this type of finish went out of fashion and other means were taken for decorating the surface. Someone, however, still desirous of continuing or reintroducing the burnished surface, seems to have thought of the idea of making the stone turn. This was then fixed on a pivot so that it could revolve slowly when turned by the hand or the bare foot. Such revolving stones, turned usually by the bare foot, though sometimes by the hand, are still used for this purpose in Japan, and the present writer has seen one so worked by the maker of the best porcelain in that country. Similar wheels are still used in India. The treadle-turned wheel is a much later invention.

Pottery is made by most peoples to-day, except the Australians and the Polynesians. In New Guinea some

tribes make pots and others do not. In primitive communities the potters are usually the women, but in the Andaman Islands both sexes undertake this work. The pot is built up by continuous coiling and the surface is smoothed with an *Arca* shell. The pot is then decorated with simple incised designs drawn with a pointed stick; it is then first dried in the sun, or before the fire in wet weather, and is then baked by lighting a fire of wood both inside and outside.

How the art of making pottery was first discovered is uncertain. Professor Gordon Childe has suggested that possibly the practice of making wattled huts, daubed with clay, had arisen earlier; then some of these were burnt down and the clay baked, thus giving the dispossessed inhabitants the idea of making pottery. This is, of course, a possibility. The fact that many of the early pots were made in imitation of baskets, as was described in a former chapter, has led some anthropologists to believe that clay was used for plastering on the inside and outside of baskets, to enable them to hold water and to withstand the fire. After a time, however, it was realised that the basket foundation was quite unnecessary and that the clay by itself would make a more satisfactory vessel. The Coconinos Indians of Arizona used to roast seeds, crickets, and bits of meat in wicker trays coated inside with clay, which was pressed while wet into the wicker-work and allowed to dry. The food was placed in the tray with glowing embers and shaken to and fro while the embers were kept alight by blowing upon them. Thus the food became cooked and the clay baked into a kind of pottery. In some such way, we must imagine, men learned that from baked clay it was possible to make vessels capable of holding water and withstanding fire, and the example from Kenya shows us that this method of coating baskets with clay was practised by a hunting people in the Upper

Palæolithic Age of East Africa, and a similar practice may have prevailed among the cave men of Europe. Nevertheless it is unlikely that true pots, which, being heavy and fragile, are not easily carried about, were made until man, by the discovery of grain-growing, had an assured means of livelihood and a settled home.

As we have seen, the earliest pottery that we know from Egypt is the Tasian and the Badarian; both of these seem to have been formed on a leather model. In Mesopotamia a small quantity of rough pottery, decorated with impressed designs in the form of small rings, has been taken from the lowest layer on the site of Kish. Above this were fragments of beaker-like pots, and above this again painted wares. Two early types of painted pottery have been found in Mesopotamia, both of them dating from before the Flood. These are the buff and black ware, found at Tell al 'Ubaid and elsewhere, and the red or polychrome ware, found in the first instance at Jemdet Nasr, near Kish. Dr. H. Frankfort has suggested that these wares belonged originally to two distinct civilizations. The buff and black ware, which occurs also in the lowest layer at Susa, he called the highland ware, because he believed that it had been first made and used on the Persian plateau. That he was correct in this surmise has been proved by the fact that, since he expressed this opinion, Dr. Herzfeld has found great quantities of a similar and closely related ware on the sites of a number of deserted Neolithic villages, near Teheran. The polychrome ware he termed the lowland ware, believing that it arose somewhere in the lowlands between Mesopotamia and the north-west coast of the Mediterranean. This view has not yet, however, received corroboration.

The earliest pottery to be found in Europe is in the

south-east. In Crete quantities of fragments of a black or dark grey pottery have been found, which date from before 3400 B.C. It had been carefully burnished, and some of it had been decorated with incised designs consisting of geometric patterns, often filled in with white clay. Almost as early are some of the pots found in graves in the Cycladic Islands, the decoration of which so closely resembles basket-work. In Thessaly, too, in the north of Greece pottery goes back at least to 3000 B.C. if not earlier; here some of the earliest pots show signs of having been copied from metal models, for the heads of rivets are represented, though the people in Thessaly at that time seem to have been ignorant of metal. In the Middle Danube basin we find about the same time pottery, some of which seems to have been copied from gourds; it is believed that these forms had been introduced from Asia Minor. This type of pottery spread up the Danube and reached the Rhine and beyond before 2500 B.C. At the same time another type of pottery, gaily painted in a number of elaborate designs, was being made in parts of South Russia, west of the Dnieper, and in some parts of Roumania. Painted pottery, not unlike this, has been found at Anau on the south of Russian Turkistan, in North China and in Southern Siberia. It is believed by many that these wares are all connected, and that these regions were in touch with one another, because they surrounded a great area of steppe or grassland, over which transit was easy, and which was then occupied by pastoral nomads, who carried the idea from one edge of the steppe to another.

The potter's art seems to have been introduced into Spain from Greece about 2400 B.C., with the knowledge of agriculture, and from the peninsula both arts were rapidly carried over the whole of West Europe, as far as the Rhine, where they met the civilization that had

come up the Danube Valley. Both arts soon reached Britain from Northern France, and a further wave of culture was carried round the Atlantic coast of Europe, up the Irish Channel and around the North of Scotland, and reached Denmark and the Baltic Sea.

CHAPTER XVI

THE EARLIEST TEXTILES

Textile fabrics, properly so called, are the results of weaving, though, as we shall see, certain fabrics, which somewhat resemble them and are used for a like purpose, are made by another process. In its simplest form weaving consists of laying out a number of threads side by side in the same direction; these are collectively known as the warp. Then a number of other threads, or in most cases one long continuous string, is run across these, usually at right angles, so that the string goes under each alternate strand of the warp and over the other; this cross-string is called the woof. When the woof, if it is a continuous string, has thus been carried right across the warp it is returned in the opposite direction, but this time it reverses the process and goes under the strands over which it went in the preceding line. This process is continued, each line being the reverse of its predecessor, until the woof has reached the end of the warp, when the piece is considered complete.

Such a simple process of weaving is involved in making woven baskets and in the wattle-work of huts, and, as we have seen, baskets were certainly made in the upper Palæolithic Age in Kenya, and very likely in Europe as well, while the wattle-work hut must go back, at any rate, into Mesolithic times. It is clear from this that the principles of weaving were known to man before he discovered the art of growing grain. There is, however, another process necessary before textile materials could be available

for clothing, or indeed for most purposes. This is the preparation of the strands. These may be natural or artificial, and it was not until man could make soft and pliable strands by the process of spinning that he could make much advance in the production of textile fabrics.

Still it was possible to do something with natural materials only. Rushes and reeds and narrow leaves, like the fronds of palms, could be woven into mats, and it seems likely that this was the first form of weaving to be employed after the construction of baskets and wattle-work. The simplest mats may be made of dried rushes or grass, but many other materials may be used, though among primitive peoples it is usual for these to be natural products, either totally unprepared or merely cut into long strips. It is seldom that any appliance is used for the manufacture of these primitive mats, for the intertwining of the warp and the woof is carried out solely with the fingers, though in some cases, where the warp is of a stiffer material than the woof, these strands are set in a rough frame. The warp and the woof are frequently made of different materials, or of different colours, thus producing a chequer-work design like those to be seen in many baskets.

No strictly hunting peoples are known to have made mats or to have done any weaving except basket-work or possibly wattle-work, so it is very doubtful whether mat-making had developed even in the Mesolithic Age. It is probable that the first impulse came to the pastoral peoples on the steppes, for such nomads are to this day great makers of mats and carpets, which they use for the floors of their tents. The huts of the antediluvian people of Tell al 'Ubaid seem to have been made of something like mat work, while shelters from the sun, made of three or four mats slung between a few light poles, appear to have been used at an early date in Egypt, and probably go back to the earliest predynastic times. Thus it seems likely that,

mats were first made as man was passing out of the stage of a hunter or a food-collector and becoming a pasturer of cattle or a grower of grain. Although positive evidence, from the nature of the case, is lacking, we cannot altogether rule out the possibility that some efforts at mat-weaving may have been made in still earlier times.

Though not strictly speaking a textile, in the accurate sense of the term, a short description must be given of bark-cloth, which is often used as a substitute among primitive peoples, especially in dry climates, where it is used for clothing and for blankets. To produce this the bark is stripped from the trees, and the outer rind is scraped away leaving the soft inner lining. This is soaked in water for some time and is then hammered with straight wooden beaters upon a log or table. The beaters may have square, round or oval sections and are usually scored with grooves, usually longtitudinal but sometimes transverse. They are nearly always made of wood, but stone beaters are sometimes used in New Guinea and implements of ivory in some parts of Central Africa. The beating is performed to spread out the bark and to reduce its thickness, and it serves also to consolidate the texture of the cloth and to give it greater firmness.

Bark-cloth is made in this way in some parts of Africa, in the Malay Peninsula, in Borneo, in most of the Pacific Islands and in a few places in America. It is always made by people living in a primitive way and unaccustomed to weaving anything but the simplest mats. These people have, however, all or most of them passed from the hunting or food-collecting stage. Felt is a somewhat similar material made from the fur of small animals. It seems uncertain whether any of these materials were made very early, and before the custom of grain growing had developed; yet the wide distribution of the art, from Central Africa to America, warns us that its origin must have a respectable antiquity.

True weaving, as we have seen, is nearly always carried out with threads or strings specially prepared for the purpose, and though weaving with such materials may not be older than agriculture, the preparation of string must be much more ancient, for it was needed at an early stage by hunting and fishing people.

It has been well said that every region of the earth has its own string. The inhabitants of the Arctic regions make theirs out of the sinews of animals, the Japanese from tough mulberry paper, the Chinese use bamboo splints as well as silk, and in most of the Pacific Islands it is made rom *coir*, a fibre prepared from the outer husk of the coconut. In Mexico and South America the *pitta* fibre and cotton are the chief materials used, Indian hemp is used over most parts of North America, while in other regions bast from trees or hair is the substance employed. Thus string of some kind is used all over the world and even the aborigines of Australia make a twine, those in Queensland using the stalks of the *kalo* flax.

String cannot be dealt with completely without the consideration of ropes and thongs. Cords are sometimes made of rattan, sometimes twisted but often not, but ropes are nearly always made of hide among primitive peoples. Very often these ropes of hide are not twisted at all, as is often the case among the Eskimo and many African tribes, but these strips tend to twist and to kink while in use, and so most tribes have found it more convenient to twist them intentionally, thus producing a round in the place of a flat thong. In the case of hide it has often been found necessary to give them greater strength, especially when used as a lasso or for the bolas, and this has been achieved by platting three or more strands together, thus making a rope which cannot be matched for strength and convenience.

Since string and rope are used by many peoples still in

the hunting stage, we may well believe that these accessories were known to Palæolithic man, who would have found ropes valuable aids to the capture of wild beasts and string or cord an almost necessary appliance for catching fish. Whether such ropes and string were twisted or platted or used without preparation we cannot say, but since twisting has been carried far among the Australian aborigines, it is likely that our hunting predecessors were not wholly ignorant of that art.

True textiles need to be woven of twisted or spun thread or yarn, so we must inquire how and when the art of spinning began. Spinning consists of twisting the material to be spun between the finger and thumb, but, if it is to be even, the thread when spun must be kept taut. This is done by means of a spindle, which in its simplest form is a stick, about a foot or less in length, to which the end of the thread is attached, and it is kept hanging from the hand that is spinning and revolves during the process. As a stick is rather too light to keep the hanging thread taut, it is customary to place near one end of it a spindle-whorl, which adds weight and enables the spindle to revolve more readily. When the spun thread is so long that the spindle reaches to the ground, the thread is wound upon it, fixed in a nick, and the process starts again. The spindle-whorl performs the additional function of preventing the coil of thread from slipping off the bottom of the spindle. The material to be spun is attached loosely to a stick, sometimes with an expanded end; this is called a distaff. Spinning, especially with a spindle and distaff, is essentially a woman's occupation, and in most communities is the business of the unmarried daughters, who in our language are often still called spinsters.

The spinning of the *kalo* flax by the aborigines of Queensland has been thus described by Mr. W. E. Roth, who spent much time among them. "The plant is collected

into thick bundles, up to four and five feet long, and each tied round with string, the whole being then immersed in water for several days, with rock or stones on top to prevent its being washed away. Its fine outer skin is next stripped off the stems, one at a time, and beaten up and teased out until such time as it becomes quite soft, when it is sun-dried and rolled into skeins or bundles about a couple of feet in length. As the individual, who is sitting in the squatting position, wants to work it up, he pulls out of the skein a piece or two, some three or four inches long, and moistening it either with his mouth, or dipping into some water provided in a *koolamon*, or wooden trough, at his side, places it crossways on his thigh; another and another thin and small length is picked off, treated similarly, and placed side by side upon the thigh, along which all three or four are rolled backwards and forwards with the open hand, until by twisting and rolling these few thin sets of shreds become a single composite one. When the next piece of composite thread is in similar manner made up from its three or four single components, it is placed end on end, not sideways, of course, with the first made composite one, and by a little rolling manipulation of the fingers, intertwined with it; a piece of about seven or eight inches is now obtained. By a repetition of this process the length of the newly manufactured twine is gradually increased, while what is already made and completed is rolled up into a ball." This process of twisting on the thigh is used by many backward races, and the yarn thus produced is sometimes wound on a stick, thus leading to the use of a spindle.

In other parts of Australia string is made from human hair or from the fur of the opossum or kangaroo, and a simple spindle is employed. This is usually a stick about eight inches long ending in a hook. A short length of hair that has been twisted is attached to the hook and

further twisting is done by rolling the spindle on the thigh, after which the yarn is wound on the stick, the hook preventing the coil from slipping off at one end. This is the simplest form of spindle known and the only example that occurs among hunting tribes. Other simple varieties, usually with a spindle-whorl, have been used throughout every continent in the world, and are still used in South-east Europe, where the present writer has often seen the spinsters at work as they walked through the cornfields of Greece. In some more advanced countries the spindle gave way to various forms of spinning-wheels. In the *charka* or spinning wheel of the East the spindle is mounted horizontally and is turned by means of a wheel, with which it is connected by an endless cord; there is generally a separate bobbin fixed on the spindle to receive the yarn when it has been spun. Similar to this is the *muckle*, a large wheel, which was used in Europe as early as the fifteenth century and was still employed in the West of Ireland quite recently. The small spinning-wheel, known as the Saxon wheel, was developed in Europe in the sixteenth century for spinning flax; in this the driving wheel is worked by a treadle. The present writer saw such a spinning-wheel being used by an old lady, a good many years ago, in a little town in Brittany. Few of these simple appliances are now to be found except in the most remote districts of the civilized countries, for the spinning machine, invented in the middle of the eighteenth century, has ousted them elsewhere.

From this we see that spinning in a very simple form is used by people still in the hunting state, and that some of these have even invented an elementary form of the spindle. This leads us to suspect that for the purpose of making string for fishing lines, spinning of a kind may have been used by man in Mesolithic, or even in Upper Palæolithic, times. It is probable, too, that nomad herdsmen, or

more probably shepherds and goatherds, finding scattered remnants of wool and goats' hair attached to thorn bushes, would have collected these scraps and twisted them in their fingers and thus made yarn. Unfortunately we have no positive evidence to support either of these suggestions. If hunting men used the spindle, it was almost certainly a form without a whorl, for these, usually made of stone or earthenware, would have been found on the sites of their habitations. Early herdsmen and shepherds wandered so incessantly, and had so few possessions that were not perishable, that we know nothing directly of their goods and modes of life. We cannot, therefore, be sure that true spinning or true weaving was carried on before agriculture had changed the life of those that had adopted it.

The real textiles are made on a loom with thread or yarn spun on a spindle. Thus this art is really a result of the convergence of two quite distinct processes, basket-work, in which we may include wattle-work, on the one side, and twisted string on the other. This art involves two separate inventions, both of which had developed for some way before they were brought into combination.

The loom has passed through a great number of stages in its evolution, only a few of the more important of which can be dealt with here. In some of the Solomon Islands in the Pacific Ocean the inhabitants make armlets of fibre on a small loom of very simple construction. A small frame is made of the two halves of a split stick, which are tied together at the ends and separated from each other in the middle by two wooden struts about four and a half inches long. The warp consists of a long narrow band of bast, which is wound round the frame to form a series of parallel strands. A weft of the same material is passed across the warp over and under alternate threads, first one way, then back again and so on. To assist the weaver a thin stick is

PLATE XLIX. WOMAN WEAVING IN BORNEO

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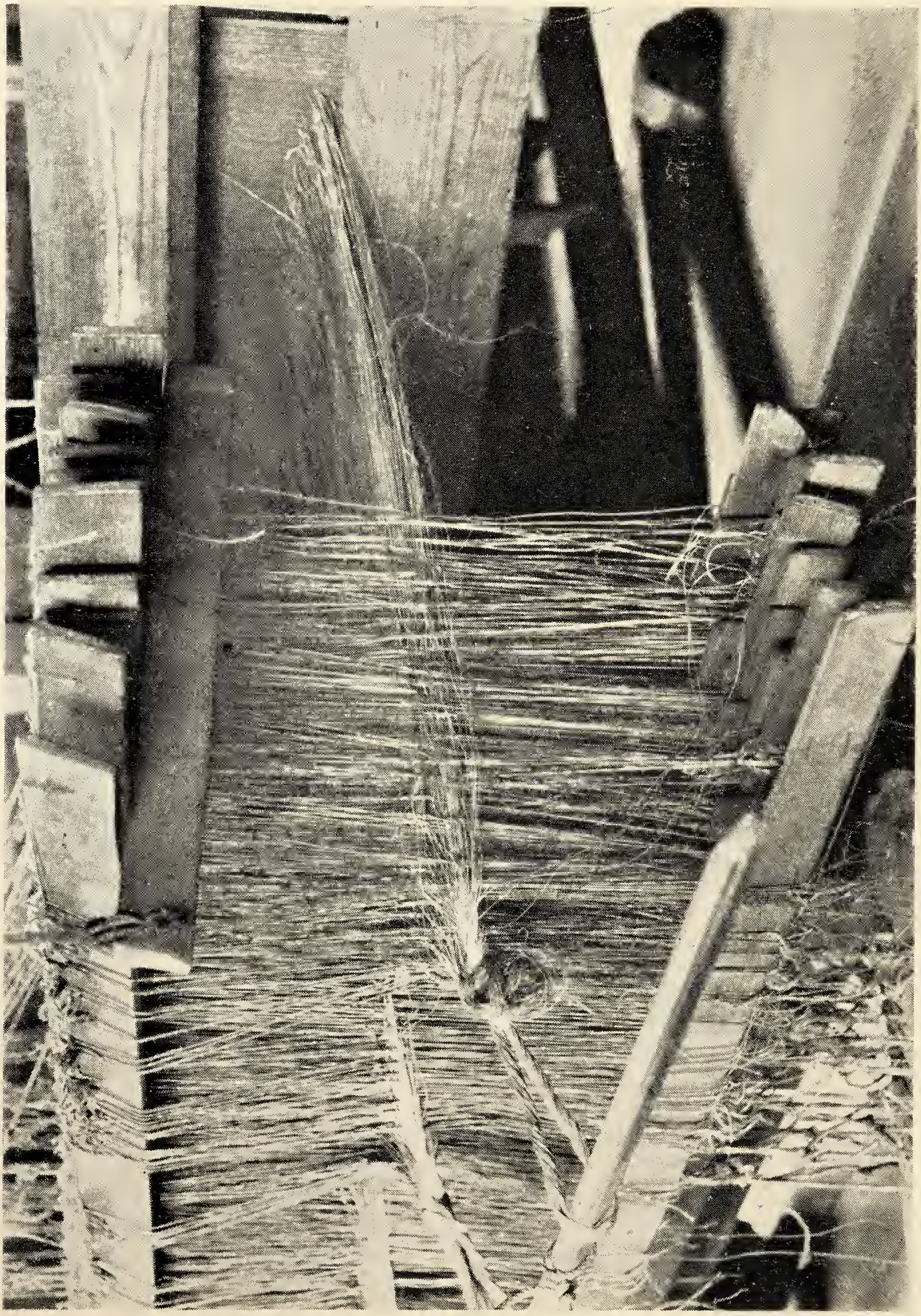

PLATE L. A FRAME HEDDLE

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first threaded across the warp, over and under alternate threads, and then remains in position till the work is completed. The woof is threaded entirely by hand, without the aid of a spool or shuttle, though small sticks are used to help in separating the strands of the warp. It may be argued that such an appliance is not a true loom, but it is the first stage towards one, and frames of this kind are used by the Maori in New Zealand, and by some of the Indians of North-west America in making their cloth-like mats.

The most important step in the evolution of the loom was made when a method was invented whereby the whole set of alternate threads of the warp could be shifted by a single movement, enabling the woof to be passed easily and quickly across the whole breadth of the warp; when the latter was narrow, this could be done by one thrust of the shuttle or whatever was used in its place. Simple looms of this type are used at Santa Cruz and Borneo. In these looms the warp is crossed by a rod to which are attached a number of loops of string. These loops connect the rod with alternate strands of the warp, so that by raising the rod these strands are also lifted up so as to make a ready passage for the woof. For the return passage another rod has to be used; this lies over the strands connected with the first rod, or heald, and under those which are not. By depressing this rod the heald strands are brought below the others and the relative positions of the two sets are so changed that the return passage of the wood passes above those below which it first ran.

Looms of this type, with many differences in detail, are found in use to-day over a wide area, and were formerly used in many civilized countries where they have now been abandoned for power-looms. They may still be found in North India, Burma, among the Ainu in the

north island of Japan, in the Philippine Islands, Formosa, Borneo and the other East Indian Islands, and this loom has lately spread into the Pacific Ocean as far as the Caroline Islands and Santa Cruz. Similar looms were used by the ancient Mexicans and Peruvians, and the use of these still survives in many parts of both North and South America. This rod-heald loom has a wide distribution in tropical and Northern Africa, and was used by the ancient Egyptians and Greeks. It seems to have been in use at one time over the whole of Europe, since it survived in the northern part of this continent and in Iceland until recent times.

We have no space to deal with all the variants of the rod-heald loom, or the various forms of the spool or shuttle which carried the woof in its passage. A great advance, however, was made when it was superseded by the frame-heald loom. This loom, sometimes called the frame-heddle, is made up of two parallel rods, connected together by a number of thin straight bars, each with an eye in the centre. Sometimes the bars may be replaced by loops of flexible strands, one set attached to each rod, and each loop connected with the corresponding loop on the other rod in such a way as to form an eye or *mail* halfway between the two rods. There are various ways of constructing this appliance, but the essential feature is that the mails, whether rigid or flexible, should pass from one rod to the other. Sometimes one, but more often two, healds are used. The work is stretched horizontally, and the healds are suspended above it, with their planes at right angles to its direction. Each warp passes through an eye in one of the healds and between the bars or loops of the other. The healds are so suspended that they can be worked with the feet, usually by means of treadles, so arranged that when one goes up the other goes down.

The origin of this kind of heald is not known, but it

seems likely that it was derived from the rod-heald. It was used in Europe as early as the sixteenth century, and was introduced into West Africa about the same time by the Portuguese. This type remained in use in Europe without much change until 1753, when the flying shuttle was invented, and before long power-looms began to replace hand-looms in all civilized countries.

How early looms for weaving were used is uncertain. It is said that in graves belonging to the first settlement at Susa there were copper axes found, that had been wrapped in linen cloths. This implies that weaving had already advanced well beyond its initial stage. Since the pottery found in these graves closely resembles that from Tell al 'Ubaid, it is now generally agreed that the first village at Susa dates from before the Flood, so that it is probable that weaving with looms goes back to the very dawn of agriculture. In most of the civilizations in the Near East we have some indication that textiles were produced, even if it is only the presence of spindle-whorls, and weaving was well known in Central Europe before the beginning of the Bronze Age. In the West of Europe similar evidence is lacking before the Early Iron Age, but, since the civilization of the Late Bronze Age here was derived from Central Europe, it is probable that weaving was introduced into the West at that time, if it had not existed there before.

CHAPTER XVII

TRANSPORT BY WATER

WHILE man was a hunter he travelled about on foot all over the land, but, when he came to water, if it was too deep to ford, he met with a serious obstruction. It became necessary, therefore, to find some means of crossing. In early days he must sometimes have seen tree trunks floating down a river, and this would have given him an idea. He doubtless seized a suitable log stranded on the river bank, and sitting astride of it was carried across by the current. He soon learned to guide the log by using his arms and legs as paddles, after which he used sticks for the same purpose. Since a log is not very comfortable to sit on, and it is not easy to carry much on its surface, two logs were sometimes lashed together; these formed a small craft, and enabled a man to carry his family across a river, together with some of his goods and chattels. Some such methods as these must have been used by Palæolithic man, for his wanderings were never hindered by rivers however large or swift, and it is likely that these methods of water transport were still further developed in Mesolithic times, especially by the food collectors living on the banks of lakes and rivers or on the seashore, for these people seem to have depended to some extent on fishing. By some such simple craft the aborigines of Australia must have crossed to their island continent, separated at that time from the mainland of Asia by one relatively narrow channel, for boats and canoes, even of the most primitive kind, were

quite unknown to these people until introduced in recent years to part of the northern coast across Torres Straits from New Guinea.

Logs and rafts are not, however, very convenient methods of water transport, for they are difficult to steer. In a river they would be in constant danger of drifting on to the side or on to mud banks, while at sea there was the risk of being carried far out by the tide and of finding it impossible to return. As soon as the simplest carpenter's tools were available, which seems to have been early in the Neolithic Age, an attempt was made to shape and hollow out suitable logs, with stone axes aided by fire, and thus there evolved the dug-out canoe.

To make a dug-out canoe a large tree is felled, or a suitable fallen tree is selected, and a shallow trough is chipped out from its upper surface, with a stone axe or adze, while it is lying on the ground. The shallow trough thus made is gradually enlarged by burning a fire in it, and the charred portions are cut away, and further fires lit until the hollow has been made sufficiently deep. In the most primitive canoes of this type little is done but making the hollow, but in most of them the ends are shaped with an axe, and in the best of them the outline is very carefully fashioned. In some cases the capacity of these dug-out canoes is increased by a very ingenious process. The dug-out is filled with water, which is raised to a high temperature by dropping into it a number of stones heated in a fire. The action of the water and the heat combined causes the sides of the canoe to expand, and these are kept from shrinking again by the insertion of cross stretchers or thwarts. In some places this process is carried out by means of wet sand and the action of the sun's rays.

Dug-out canoes have been used at one time or another

in many lands. A number have been found embedded in peat in Northern and Western Europe, and especially in England and Wales. They were in use in Ireland as late as the end of the seventeenth century and they are still used in Roumania. They are in common use by the inhabitants of most of the islands of the Pacific, who have travelled enormous distances in their great war canoes. They were made and are still used sometimes by some of the Indians of North America, and the present writer crossed the Frazer River in British Columbia in such a canoe more than thirty years ago.

The dug-out canoe is strictly limited in its capacity by the size of the log used, and this seldom attains to very great dimensions. This difficulty is often met, especially in the Pacific Islands, by lashing a long plank upright along each side of the canoe, so as to increase its capacity. When this is done it becomes necessary, not only to add stretchers or thwarts of increased length and size, but to add vertical supports beneath the centres of these. Sometimes a second plank is placed above the first, when we have the early stages of a built boat.

Another simple method of crossing rivers, used in early days, was the use of skins. On the upper reaches of the Blue Nile the inhabitants still cross the river on an ox skin, on which a bundle of brushwood has been piled. The ends of the skin are drawn together to some extent over the top, and, provided this craft is not too deeply submerged, it retains sufficient buoyancy. Lower down the Nile, in the neighbourhood of the Cataracts, skins of sheep and goats, normally used for carrying grain or water, are inflated with air after all the openings have been securely closed. One of these inflated skins is placed under the chest of the swimmer, keeping him sufficiently out of the water to enable him to carry his clothes and

his arms over dry. A similar method was used in early days in Mesopotamia, but here ox-skins were used, thus enabling a man, stretched full length upon the float, to keep his body almost entirely out of the water. A number of these inflated ox-skins were sometimes placed beneath a rough raft of light logs, and by this means quite heavy loads of goods could be carried across the rivers. Such rafts, supported by inflated skins, have been used in the Tigris right down to the present day and are occasionally used as ferries in the northern parts of India. The more usual method, however, in the latter country is to support the raft by a number of earthenware pots, known there as *chatties*.

A somewhat similar craft is still used in Mesopotamia. These are circular baskets, known as *gouffas*, plastered inside and out with the native pitch or bitumen. They were formerly covered with skins, sewn together and made watertight, and the use of these goes back to a very early date. Very similar to these are the coracles, used in Welsh rivers, especially on the Dee and on the Wye. These are made in the same way, and were formerly covered with skin but now with canvas. Similar to these are the curraghs of North-west Ireland. These, too, are covered with canvas, but a drawing made in 1685 shows one covered with skin. Skin-covered boats or canoes of a totally different shape are used by the Eastern Eskimo, who call them *kyaks* or *uniaks*. These are built with a keel, a stem and a stern-post, a style probably derived from the ships of the Vikings. The Western Eskimo also use a skin-covered boat, known as a *bidarka*; this is a canoe of wattle-work, but its shape has evidently been copied from that of the dug-out canoes used by the neighbouring Indian tribes.

Not unlike the skin canoes are those made of bark. These are most commonly used in America, but a few

have been found in use elsewhere. Some of the Australian tribes make simple craft of this kind and the extinct Tasmanians used rolls of bark as well as bundles of reeds for making simple boats. The most primitive type of bark canoe is that made in the Guianas and by the Amazon. This is called a "wood-skin," and is a rough length of bark stripped from a large tree, and sufficiently curved and closed at the ends to keep out the water. The canoes made by the inhabitants of Tierra del Fuego are constructed of bark stretched in light wooden ribs, arranged quite close together.

One of the earliest types of river-craft that we know is that first used by the Predynastic Egyptians. This was made of bundles of papyrus reeds, bound together to form a canoe with upturned ends. Canoes of the same material and of exactly the same shape are still in use on Lake Tana in Abyssinia, and the *ambatch*, now used on the White Nile, is almost identical, but has a blunt stern. Boats made of reeds are used in many other parts of the world, where reeds are common and timber cannot be obtained. They are used on Lake Chad and on a few other lakes in tropical Africa, as well as in South Africa and in Peru, and they only disappeared from Tasmania on the extinction of its primitive inhabitants.

The earliest evidence that we have of the reed canoe in Egypt comes from the Middle Predynastic or Gerzean period, when we find them figured on painted jars. They remained in use on the Nile at any rate as late as the time of the Twelfth Dynasty, but were only serviceable as river-craft and were useless on the open sea. The earliest wooden boats in Egypt were made in imitation of these reed canoes out of the only timber available in that country, the wood of the *sunt* or acacia tree which never reaches any size. For sea-going boats wood had to be imported from North Syria, and quite early in

a. A dug-out canoe in Roumania

b. A raft on the Tigris

PLATE LI. DUG-OUT CANOE AND RAFT ON TIGRIS

Plate LII. Gouffa on River Tigris

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dynastic times expeditions went thither to procure it. Such timber was not, however, imported in any considerable quantity before the time of the Eighteenth Dynasty. Before the Predynastic period, in Badarian times, there seems to have been larger timber available in Egypt, and the people seem to have used dug-out canoes; for among the remains from this time has been found a terra-cotta model of such a canoe, with an overhanging stern. Soon after Badarian times the climate in Egypt became drier, large trees no longer could grow there, and during the Early Predynastic or Amratian period it became impossible to obtain logs large enough to construct dug-out canoes, and by degrees the reed canoe took its place.

We have already seen that for navigating the Tigris and Euphrates very primitive craft were used in very early days, and are employed there to-day. These consist of inflated skins, with or without rafts, and the skin-covered baskets called *gouffas*. Evidence has recently come to light that as early as 3000 B.C., and perhaps much earlier, boats of a much more advanced type were constructed. A few years ago Mr. Woolley found, in a tomb at Ur, a well-made silver model of a canoe. This represents a long boat with upturned ends propelled by nine paddles. Similar boats, of wattle covered with bitumen, with high pointed bows and sterns, are still made and used by the natives of the marshes that border the head of the Persian Gulf.

Boats of this type are evidently of high antiquity. One such boat, with high prow and stern, is depicted on the gold repoussé handle of a knife, found some years ago at Gebel Arak, and believed to date from the closing years of the Gerzean period, about 4000 or 3900 B.C. The scene in which it occurs represents the landing of a band of hostile invaders, but whether upon the Red

Sea or Mediterranean shore of Egypt is uncertain. It is clearly a foreign vessel, and its resemblance to the silver model makes us suspect that the invaders came ultimately from the shores of the Persian Gulf.

It is uncertain how these boats with high bows and sterns were made, but it seems probable that they were constructed of timber and not of reeds. The shape suggests that, like most modern boats, they were built on keels. Unlike the other craft used in Mesopotamia their use was not confined to rivers but they were able to take to the open sea as is clear from the evidence of the Gebel Arak knife-handle. Now the people of Ur at the time that the silver model was made were the Sumerians, a mysterious people who arrived in Mesopotamia some little time before the Flood, and conquered the simple folk who had made the buff and black pottery found at Tell al 'Ubaid and elsewhere. Where the Sumerians came from has been the subject of much dispute. One of their most characteristic methods of decoration is work inlaid with shell or mother-of-pearl. This seems to indicate that their earlier home had been by the sea. The pearl oyster is still to be found very abundantly near the mouth of the Persian Gulf, and all the mother-of-pearl inlaid work, that is met with so commonly in oriental bazaars, is made at the centre of these pearl fisheries, the Bahrein Islands, on the southern side of the Persian Gulf. This has led some people to suggest that the former home of the Sumerians lay by the shores of this gulf, and the fact that Dilmun, a region known to have lain along one of the coasts of this gulf, was sometimes spoken of as the Sumerian heaven, lends added weight to this suggestion. This leads us to suspect that it was somewhere along the shores of the Persian Gulf that canoes or boats were first built with a keel.

How early these keeled boats reached the Mediter-

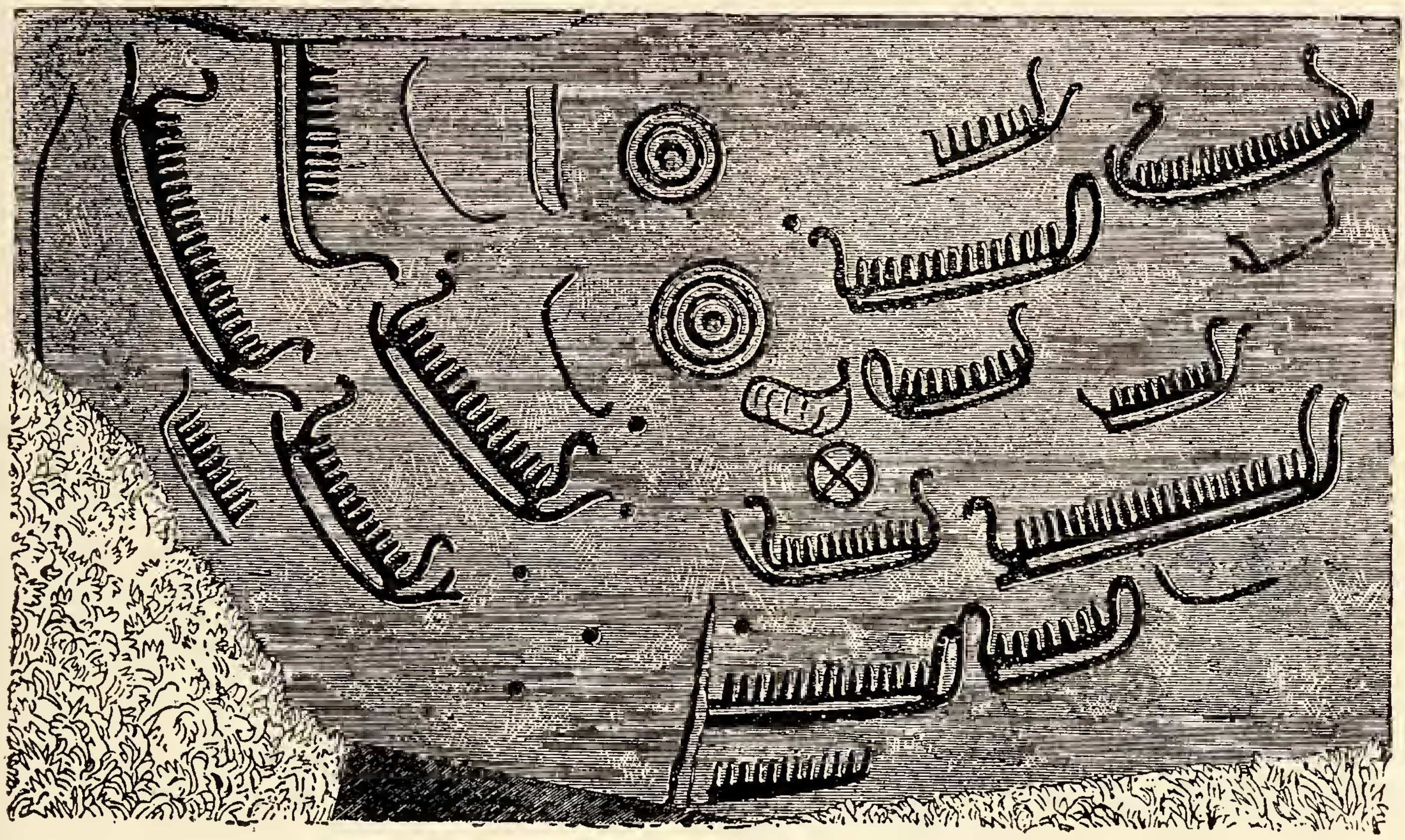

Plate LIII. Rock Carvings of Boats from the Baltic

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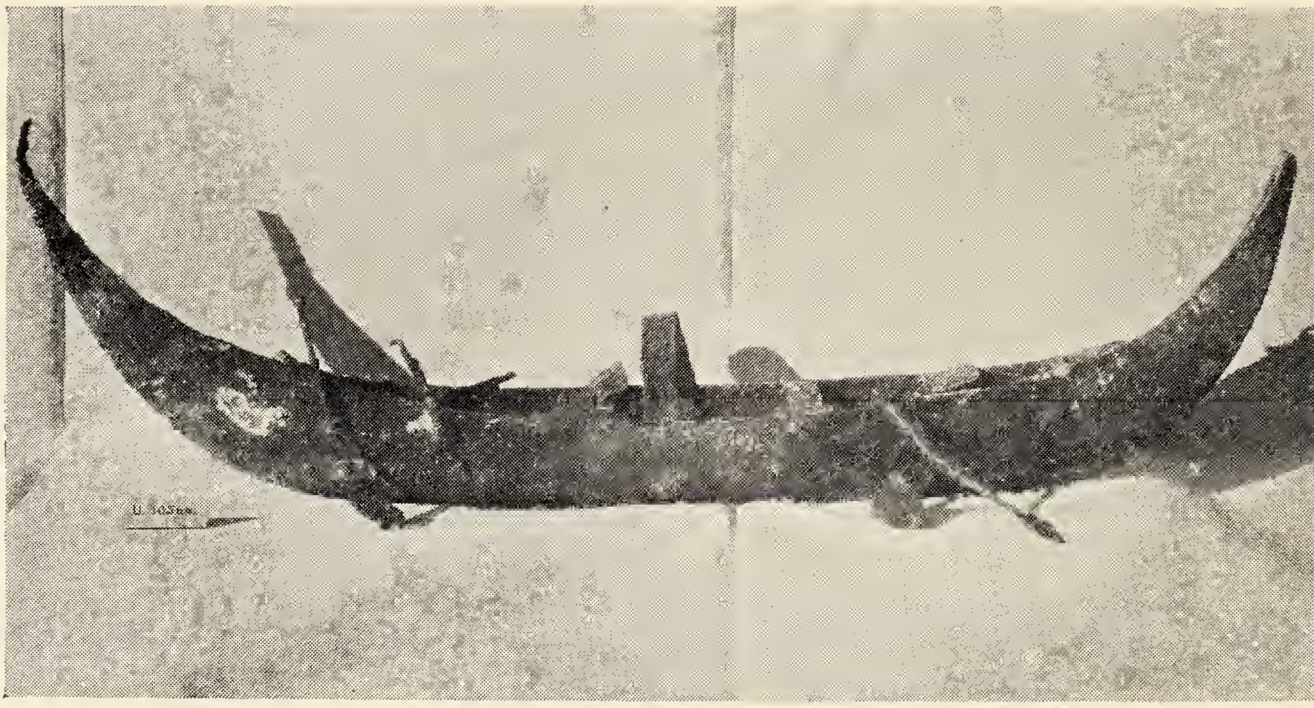

Plate LIV. Silver Model of Boat from Ur

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ranean Sea is uncertain. We have rough represenations of the boats used in Crete and in the Cyclades in pre-Minoan days, that is to say before the close of the Predynastic period in Egypt. These representations are difficult to interpret, but they seem to have one end raised and the other projecting on the water-line. By the time of Sargon of Agade, who was ruling in Mesopotamia from 2752 to 2697 B.C., the people of Mesopotamia were trading in the Mediterranean and had reached Crete and a land called Ku-ki or the tin land. They arrived at the Mediterranean by ascending the Euphrates to Carchemish and then crossing by Aleppo to the sea near Alexandretta. Since they had been using sea-going boats, probably built on a keel, for at least a thousand years and probably for longer, we can well imagine that they would have introduced this type of craft into the Mediterranean, if, indeed, they had not already done so as early as the attack on Egypt represented on the Gebel Arak knife-handle.

The keeled boat or ship, once introduced into the Mediterranean, soon developed in size and seaworthiness in the hands of the Minoans of Crete, the people of the Cyclades and other maritime peoples living on the shores of this inland sea. Though usually propelled by oars, the sail was introduced at an early date, though how early is uncertain. It has been claimed that the sail, which was always in early times the square athwart ship sail, was used on the reed canoes on the Nile in Predynastic times, though this has been disputed. It is certain, however, that such sails were in use in Egypt as early as the Second Dynasty, that is to say before 3000 B.C. Since the Sumerians seem to have been the first to use sea-going craft, it seems likely that they were the first also to discover this important adjunct for using wind-power to save man-power. Whatever its origin,

we have evidence that the square sail was used at an early date by the Minoan sailors, and doubtless its use was common throughout the Eastern Mediterranean.

It was about 2400 B.C., that the Cretans and other maritime peoples of the East began to extend their trading ventures to the West, to South Italy, to Sicily, and before long to Spain and Portugal. This brought the knowledge of the keeled ship and the square sail to the shores of the Atlantic Ocean, and we have evidence in the distribution of megalithic monuments and other elements of civilization that very shortly afterwards there was a regular maritime traffic from Portugal to Brittany, to Ireland and West Britain, and round the North of Scotland to Denmark. By this means the keeled ship and the square sail were carried along the coasts of West and North Europe, and we have evidence of their presence in the Baltic in the form of rude rock engravings made at some time in the Bronze Age.

In the hands of the Minoans, the Phœnicians, the Greeks, the Etruscans, the Carthaginians and the Romans the keeled ship developed still further in size and convenience. Such ships were still manned mainly by oars, which grew in number until there were several tiers one above the other. Though the sails grew in size, the square sail was the only type used. The "lateen" sail, which was in use in many of the Pacific Islands before they were discovered by Europeans, was only introduced into the Mediterranean by the conquering Arabs, after which it rapidly ousted the square sail for many purposes, though for long it was little used beyond the Straits of Gibraltar, except for the mizen mast.

From these small beginnings have arisen our modern ships, our great battleships and our ocean-going liners, by many small improvements. The raft, the dug-out,

the skin-boat and the reed-canoe, though still surviving in many parts of the world, were types that were unable to develop far. It was the keeled boat, invented as we suspect by the early Sumerians, while living on the coast of the Persian Gulf in days long anterior to the Flood, that contained within itself the germs of future evolution and became the prototype of the modern leviathan.

CHAPTER XVIII

LAND TRANSPORT

Hunting people travel light. They carry few goods except their weapons for the chase; baskets, leather bags and materials for a tent, if they are using such luxuries, are carried on the backs of their women-folk, who toil laboriously behind the hunting men. Thus, though they may have occasionally made use of primitive methods of water transport, when an unfordable river had to be passed, they never developed any form of land transport other than their own legs and the backs of their women, though some of the Indians on the plains of North America used a simple form of transport that will be described later.

The early grain growers were in no more need of transport. Their fields were small and lay close to their villages, and their scanty crops could easily be carried by hand to their houses or primitive grain crushers, and they required no further means of transport. It is to the early dairy-man in the mountain valleys that we must look for the first development of this. Since many of these early dairy farms were at a considerable altitude, where the snow lay deep for many weeks or perhaps even months during the winter time, it was necessary to lay by a store of food for the milch cows, who were unable to wander to the lowlands in search of pasture free from snow. Thus arose the custom of cutting long grass in the summer time and storing it, after it had been dried in the sun, for winter fodder. It is to the first hay-makers that we must attribute the idea of land transport.

At first, no doubt, bundles of hay were carried in the arms or on the back from the meadow to the byre, and after a time it was found better to thrust the forked stick, used for making the hay, through a hay-cock, and to carry this over the shoulder. This, however, was heavy work, especially if the journey was uphill, and so it was sometimes found easier to pile the hay on the end of the fork and so drag it to the byre or the rick. By degrees it was found that more hay could thus be carried if a longer and stouter pole were used, and that if ropes of raw-hide thongs were attached to one end of the pole it was easier to drag and the family could join in to bring back a larger load. Then it occurred to someone that as this food was for the beasts, it was only fitting that they should take a share in the labour of transporting it, so the beasts were harnessed to the pole and animal transport was thus introduced. Such a simple method of transporting hay to the rick is still sometimes used in primitive lands, and the present writer has seen this method employed on an up-country ranch in British Columbia, where the horse-power was in excess of the wagons available and time was of consequence.

There was only one drawback to this method, and that was that the hay-cock sometimes fell off the pole on the journey, especially if some obstruction were met with on the way. To obviate this it occurred to someone to use two poles, set a little way apart at one end yet fixed together at the other. The simplest form of this was to tie the poles together loosely at one end with strips of raw-hide, leaving the other ends spread out a few feet apart. This would carry a much larger amount of hay with less danger of spilling the load, but this way, too, sometimes presented a difficulty for the free ends of the poles would sometimes drift apart, letting the load down between them. To obviate this a short

spar was lashed across them at the far end to prevent them from spreading. Alternatively short spars were lashed across both ends, and sometimes in between, thus forming a rectangular frame or primitive sledge. The first of these methods, known as the *travois*, was employed by some of the North American Indians. It was, however, a very light construction and was drawn by a dog, upon whose shoulders the closed end was fixed. It is possible, however, that this form of transport had been borrowed from other tribes, living farther to the South, who had reached a more advanced stage of civilization. The latter of these forms differs little from the slide-car still used in Ireland. In this conveyance there are two side-poles or shafts, connected by cross-bars and fitted with a rough frame or cage to hold a basket or other load. The horse is harnessed between the shafts at one end, while the other rests upon the ground. This simple vehicle is still used in the glens of Antrim and in a few other parts of Ireland, and similar conveyances have been employed in Scotland and Wales until recent years.

If the bars of the slide-car are placed on the top of the runners it forms a kind of sledge, though to make it effective the runners should have smooth flat bases and be curved upwards at the front if not at the back too. When this is done the ends of the runners can no longer be used as shafts, and the sledge has to be drawn by traces. Sledges are now only used where there is deep snow, and so are only found in use in the Arctic regions and in mountainous countries during the winter months. They are used for a great part of the year by the Eskimo and the Lapps, and during the winter months in Switzerland and other parts of Central Europe, and in the great plains of Poland and Russia. They are usually constructed of wood, but, since this is scarce in the Arctic

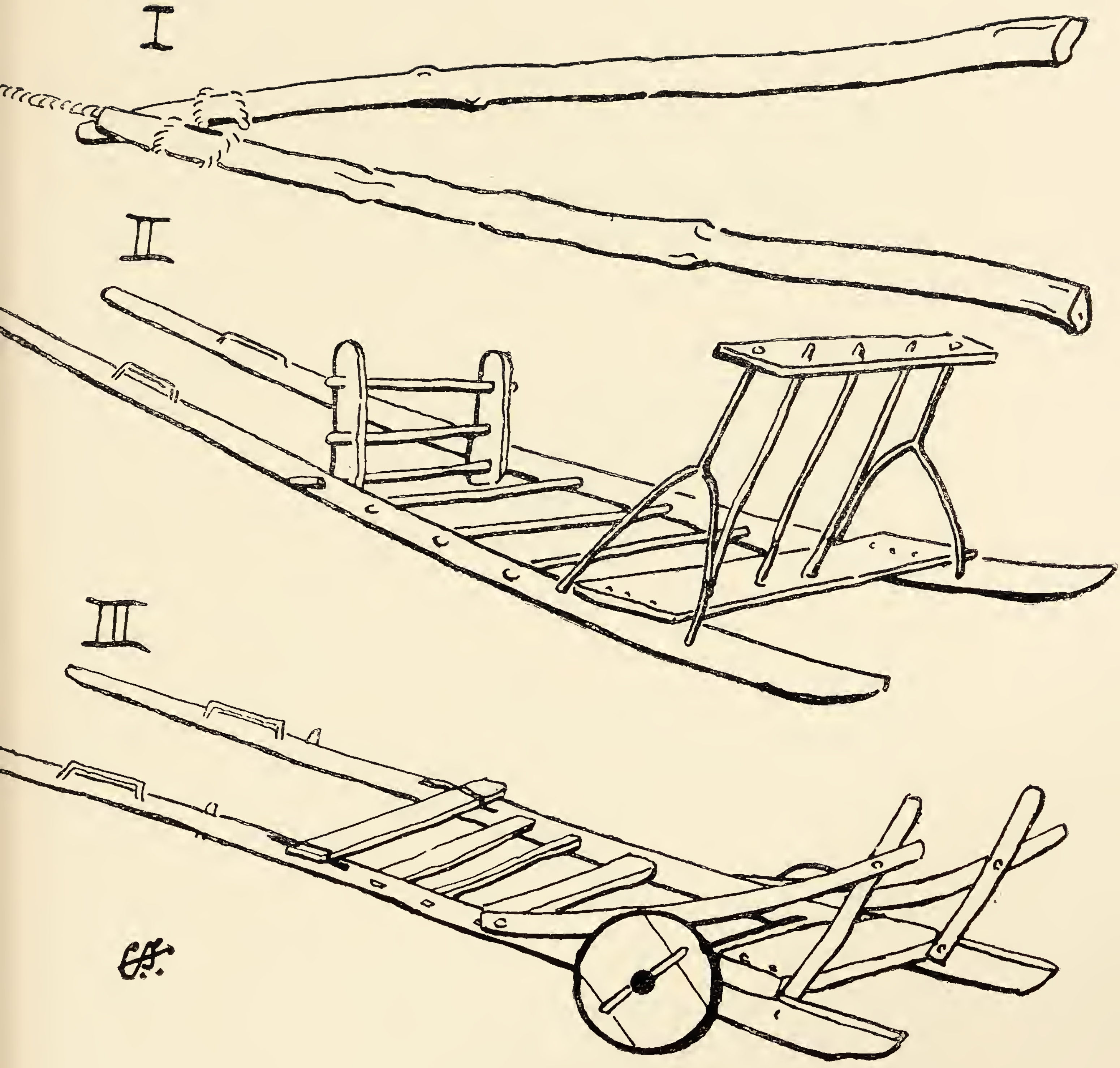

Plate LV. The Evolution of the Slide-car

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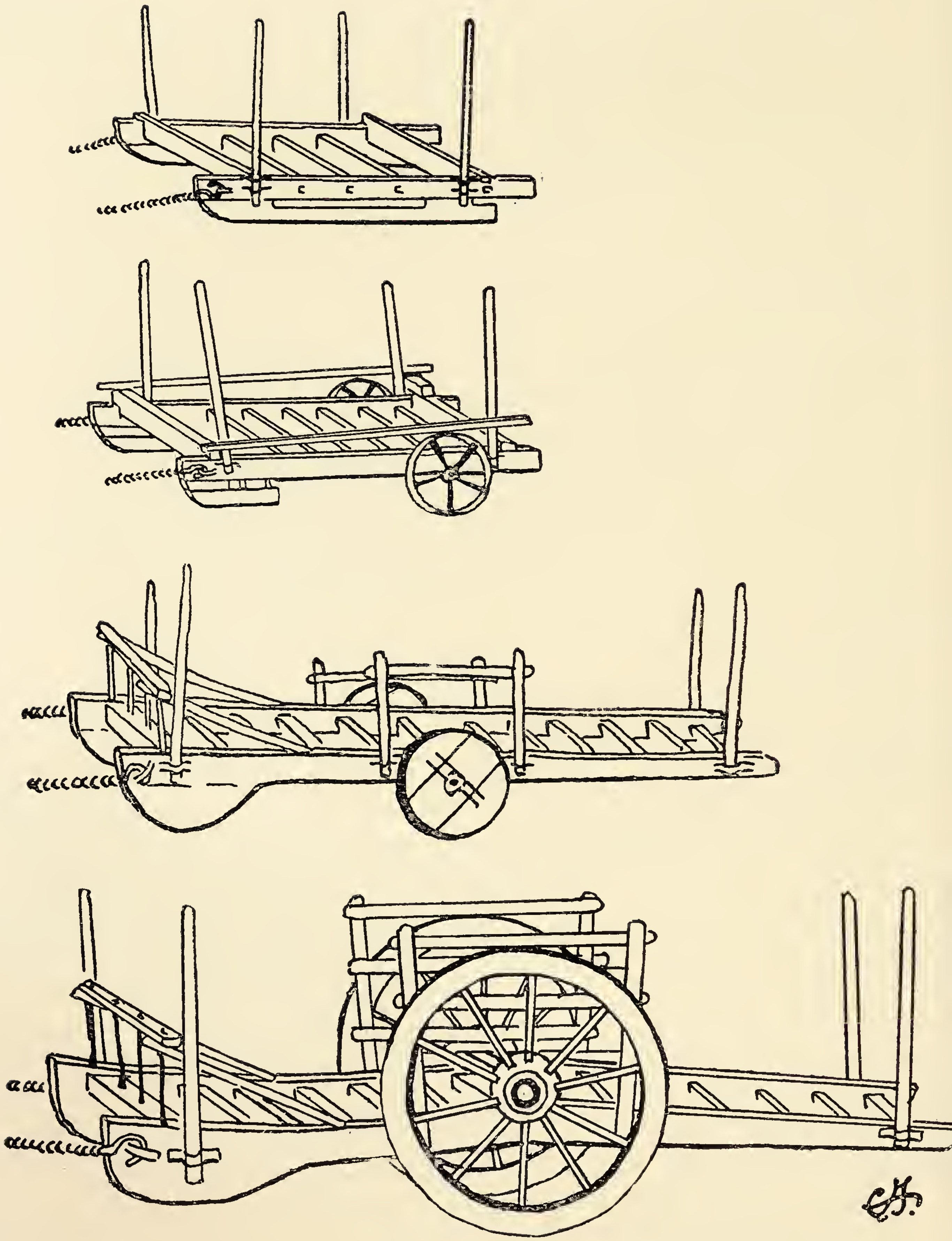

Plate LVI. The Evolution of the Wheel-car

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regions, bone and other materials are used. It is even on record that the skin of a musk-ox, flattened out and allowed to freeze until it was as hard as a board, served as a sledge on one occasion, while on another the sledge was made of a block of ice resting upon runners of frozen salmon.

The sledge seems to have had a much wider range in early days, and it was employed in Egypt for carrying great weights as late as the time of the Middle Kingdom, if not later. It was probably used to carry the large stones required for building the pyramids up a steep ramp from the bank of the Nile, whither they had been transported by boat. It seems to have been the only form of land transport available in that country until the arrival of the Shepherd Kings, though small loads were packed on the backs of asses during the time of the Twelfth Dynasty and very probably in much earlier days, since the Libyans possessed large herds of asses before Menes founded the First Dynasty. The sledge was also used for drawing great weights in Mesopotamia and was employed for this purpose in Assyria as late as the time of Asshur-bani-pal.

We must now return to the simple contrivance of two logs fastened together at one end, an arrangement that we believe to have been designed at an early date for carting hay. As we have seen, a bar would have been placed across the back, either above or below the poles, to prevent them from spreading. If the bar were placed beneath, this would often impede the vehicle, but if it were round, it would impede it less than if it were square or shapeless. If the ends of such a round bar were sharpened and inserted in holes bored in the pole, it would tend to revolve and so ease the task.

Some such gradual change we must suppose to have taken place, when it would be found that the larger the

diameter of the cross-bar or roller the easier would be the journey, except for one drawback, for the larger the roller the heavier the vehicle. Whether this difficulty in the weight was avoided by reducing the size of the roller all along except near its two ends we cannot say, for no instance has survived of such a change, but it soon became apparent that the addition of two small solid circular pieces of board at the ends of a light roller gave the advantage of the larger roller without increasing the weight. Thus the roller became an axle with a small solid wheel at either end. Such a cart, like the slide-car with a pair of small solid wheels, was in use in Wales within living memory and was known as the *truckle*. That the wheeled vehicle developed in some such way has been made clear lately by Dr. Cyril Fox in his study of the evolution of the cart in Wales, and he has given a series of diagrams illustrating four stages in the development of the wheel-car, still in use in the Principality, from a sledge which has not yet gone out of use.

Where the wheel was first invented is uncertain, but it cannot have been in Egypt, to which country wheeled vehicles seem first to have been introduced by the Shepherd Kings. The use of wheeled wagons is very old in Mesopotamia, and several wheeled vehicles, chariots drawn by asses, and wagons drawn by oxen, were found by Mr. Woolley in the great death-pits at Ur, which, as we have seen, go back well before 3000 and perhaps nearly to 4000 B.C. Thus wheeled vehicles were well known in Mesopotamia two thousand years before they were introduced into Egypt.

The wheels of the early vehicles found at Ur, though solid, were of considerable size and were made of several pieces of wood, one piece laid across the others; both shafts and a pole were known, though usually the latter

were used, since two or more beasts were employed to draw them. How early the solid wheel was replaced by one with spokes is uncertain, for there are many gaps in the evidence available from Mesopotamia. We know, however, that war chariots were used by the leaders of armies about 3000 B.C., but unfortunately the stele of Eanatum, known as the stele of the Vultures, on which such a war chariot is depicted, had been broken off just above the wheel and the lower part is missing. It seems probable that in time a tyre was added, as the cross-cut rims of the wheels would not wear well. Then, as the tyre became heavier, it was found that two cross-pieces connecting it with the hub were sufficient. However it came about, we find that in Egypt, shortly after the expulsion of the Shepherd Kings, the monarchs and nobles were using war chariots with very light wheels, consisting of a hub, a light tyre and four spokes.

In Central Europe wheels with four spokes were used up to the beginning of our era, and perhaps later, but at a much earlier date a larger number were used, for Homer speaks of an eight-spoked wheel, while among the Romans the number varied, being either, four, six, eight or as many as ten. The larger number, now more generally used, dates from a considerably later date.

The earliest wheels, especially the solid varieties, were fixed firmly to the axle and turned with it, and such wheels are still used in Ireland. The *plaustrum* or farm cart of the Romans was the same, and the type was common in the ancient world. The same arrangement can be observed in modern wagons and bullock-carts in Portugal, Turkey, China, India and elsewhere. The solid wheel is not necessarily fixed to the axle, but this is usually the case in all heavy vehicles.

The spoked wheel, as we have seen, was developed early in South-west Asia, and was adopted in Egypt

for chariots from the first. How early such vehicles were introduced into this country is uncertain. It has been suggested that they came in with the introduction of bronze, but there is little to support such a contention. It is reasonable to suppose that the invaders from Central Europe, whose arrival brought in the Late Bronze Age, were equipped with some kind of vehicle such as was well known in the region from which they came, but positive evidence for this is lacking. We do know, however, from the statements of Caesar, that towards the close of the Early Iron Age the Belgic tribes in this country possessed war chariots, and there is some reason for supposing that they had been in use here for at least a century.

It is not clear at what stage the wheel was fitted to a circular termination of the axle, so that it could revolve upon it. Such a system was in vogue among the Romans for their chariots and before them among the Greeks, who used a pin (*embolos*) running through the axle to prevent the wheel from falling off. This plan was believed by the Greeks themselves to be of great antiquity, for they had preserved a legend, in which it is stated that Pelops, the hero who gave his name to the Peloponnese, persuaded Myrtilus, the charioteer of Œnomaus, King of Elis, to remove the pins from his adversary's chariot before starting in a race that they had undertaken to run. It seems probable that it was the application of the wheeled cart to the purpose of war as a chariot, with the consequent need for lightness, that encouraged the use of the spoke in the place of the solid wheel, and led the wheel to become independent of the axle.

The earliest vehicles in Mesopotamia were drawn, as we have seen, by oxen and asses, the former being used for the heavy baggage wagons and the latter for the lighter chariots. These were the only draught animals

for more than two thousand years, until about 1700 B.C. the horse was introduced into Mesopotamia by the Kassites and shortly afterwards by the Shepherd Kings into Egypt. The advent of the horse quickly brought about a rapid change in the style of the chariots, which now became lighter, as the horse was capable of greater speed than the ass. It is, one must suspect, to the advent of the horse that we must attribute the development of the spokes and the wheel free on the axle. Oxen still remained for long the draught animals for heavy loads, where pace was unimportant; they were used in this country not so very long ago, and may still be seen drawing carts in the Mediterranean lands, over most parts of Asia, and to a great extent in South Africa. No other animal has been pressed into this service except the mule, and in rare cases the dog.

We see, then, that the wagon and the chariot or light carriage were well developed by about 1700 B.C., and since then the changes have been slight and only in minor details. No great differences in principle are observable between these early wagons and chariots and the wagons, lorries, carts, carriages and coaches of modern days. Only a century ago these were the only means of land transport, except the sedan-chair in a few cities, and it was not until the advent of railways that any real improvement was effected. The railway, and since then, the motor-car, have revolutionised land transport, which had remained almost at a standstill since the introduction of the horse, and was not greatly in advance of the means at the disposal of Queen Shubad, nearly six thousand years ago.

CHAPTER XIX

THE FIRST WORKING OF METALS

We have seen in a previous chapter that the discovery of grain growing caused a complete revolution in the life of man and was rapidly followed by a number of other discoveries, such as the possibility of building a permanent home, of making and baking pottery to hold food and drink, and of weaving mats and materials for clothing. Another and still more important discovery was made not very long afterwards, that in the earth were to be found substances which could be rendered fluid by applying sufficient heat, and could be cast in moulds to any required form. This discovery enabled man to fashion tools and personal ornaments far more readily than had been possible before, when each tool had to be laboriously flaked or ground out of a nodule of flint or a quartzite pebble.

The substances mentioned in the preceding paragraph are known as metals, and the word borrowed from that used by the Greeks, who in their turn seem to have borrowed it from others, means substances which had to be sought for. The metals known to the chemist of to-day are more than seventy in number, and possess certain qualities and behave in a certain manner when combined with other substances. In ordinary use, however, metals are substances which can be melted when sufficient heat has been applied to them, and can, in this condition, be made to take any shape that is desired. This was the sense in which the word was used before its meaning was newly defined

by the chemists. Certain metals were known to the ancient Greeks; these are gold, silver, copper, iron, lead, tin and mercury. Most of these, all except mercury, had been known and worked at a far earlier time, except that a really useful method of working iron was not known until long after it had been possible to work the others.

Although, as we shall see, the earliest metal, from which articles of use have been made, so far found is copper, there is good reason for suspecting that the first metal to be pressed into the service of man was gold. Gold was highly valued at a fairly early date, when it was used for cups and especially for personal ornaments. It occurs in many parts of the world as dust, or nuggets in the beds of streams, and, owing to its bright colour, and the fact that it does not tarnish, a nugget would be a conspicuous object and calculated to attract attention. Though the earliest objects of gold that have so far been found date from several centuries later than the earliest objects of copper, it is generally agreed that the more precious metal was the first to be noticed and used, but that, owing to the value set upon it, it was more carefully preserved and handed down from one generation to another.

How the use of gold first arose can only be surmised, and more than one suggestion as to its origin has been advanced. Professor Elliot-Smith believes that somewhere on the African shore of the Red Sea the cowry shell was used as an amulet of fertility. For some reason the shells failed to satisfy the people, or the supply of shells failed, and models of this shell were made in gold. The virtue of the amulet, originally residing in its form, became transferred to the material, and gold became and has since remained a fortunate possession.

Another and more prosaic explanation was suggested some years ago by the present writer. Primitive men, whether in prehistoric times or among backward peoples

to-day, have a habit of collecting small objects with natural perforations, or through which holes could readily be drilled, and stringing them on threads to form necklaces or bracelets. Such a custom goes back a long way, for the two earliest skeletons of modern man that are known, those of the mother and son found in the *Grotte des enfants* near Mentone, were both adorned with strings of perforated sea-shells.

The use of beads as personal ornaments goes back, therefore, to the earliest days of modern man in Europe, and beads of various kinds occur at later dates, among the Tasians and Badarians in Egypt, among the pile-dwellers in North Italy, where the *vertebrae* of pike were used for this purpose, and among primitive and civilized people all over the world. Naturally it was desired to secure, if possible, beads of a more durable nature than the shells of molluscs or the *vertebrae* of pike, and small stones with natural perforations, especially if brightly coloured, would be much sought for this purpose.

It has been suggested that the first discoverer of the use of gold was a young man, who wished to obtain the favour of a maid or to purchase her from her father. Such a youth, we may imagine, wandered in search of some object, rare, durable and capable of being strung on a necklace. While walking down to a clear stream, perhaps to drink or to fish, we may imagine that he noticed in the bed of the stream a brilliant yellow stone of quite exceptional beauty. Picking this up he would find on examination that he could bend it where it was thin, so that with the aid of a stone he was made to make it into the much-sought-for bead. We can imagine, too, that his success would have been assured, and that his discovery was followed by the first gold rush.

Copper also exists in a native state, and in earlier days must have been found more abundantly on the surface

of the ground than it is to-day. It occurs, like gold, in nuggets of varying size, and in the Minnesota Mine in the Ontanagon district in North America was found a lump that weighed 420 tons. As a rule the surface of these copper nuggets is tarnished purple or greenish black, but a little rubbing produces the bright ruddy colour that we associate with the metal. Like gold it can be readily hammered into a desired shape, and, though not so attractive in appearance, it was certainly more often met with and so became a useful material for the making of beads. Small beads of copper, strung into a bracelet, were removed by Brunton from the wrist of a woman buried in a Badarian grave, accompanied by other objects typical of that culture, so we can carry back the use of copper beads to about 5000 B.C. A few small copper objects, fish-hooks, chisels and the like, have been found in graves of the Early Predynastic or Amratian period, though it is not until the Middle or Gerzean period that they become common. Well made copper axes, made of singularly pure metal, were found in graves belonging to the first period at Susa, which, as we have seen, is contemporary with the early antediluvian settlement at Tell al 'Ubaid, while on the site of Kish some copper was found in the second layer, more than three feet below the deposit laid by the Flood. The use of copper in Mesopotamia is, therefore, considerably older than the Flood.

Copper is, as we have seen, malleable and readily fashioned into desired shapes by hammering, and it is likely that it was thus used for a long time before men learned that it could be melted, and in a liquid state run into moulds. Many of the North American Indians, such as the Hurons around Lake Superior, used copper in this way, and until the art of casting had been discovered men were using copper and gold as stones that could be

hammered into shape, and, though they were using metal, they were not true metal-workers. The Badarians and probably the Amratians too, were using copper as a hammered stone, but when we get to the Gerzean period it is different. Here the implements have very definite forms, and there can be little doubt that they were cast in moulds. The Gerzean culture contained many new elements that had been introduced, it is believed, from Asia about 4500 B.C. It seems probable, therefore, that man had learned to cast copper, probably in South-west Asia, at some time between 5000 and 4500 B.C.

The discovery that metal could be melted and cast into a desired form is a much more remarkable discovery than that it could be fashioned by hammering, and we must consider how such a discovery was made. Though copper is sometimes found in a pure state, known as native copper, it more frequently occurs mixed with other elements in the form of ores. The most noticeable of these are the sulphides of copper, chalcopyrite or copper pyrites and peacock ore, and the carbonate of copper known as malachite. Veins of malachite occur in the peninsula of Sinai, and those at Wadi Maghara were worked during the First Dynasty; copper silicate has also been found in the Wadi Samari. Malachite is a bright green mineral, which can readily be crushed to a powder, and the predynastic Egyptians were accustomed to grind small pieces of this material on slate palettes, for they used the green powder for painting around their eyes, either to keep away the flies or to reduce the glare from the sun. The same custom seems to have obtained among the Badarians, since palettes, stained with green, have been found in their graves.

Professor Elliot-Smith has suggested that a method of melting copper was first discovered by a predynastic

Egyptian, who was grinding a piece of malachite upon his palette to provide his eye-paint, when a refractory fragment failed to be crushed and he threw it in the fire. Since he subsequently found in the ashes a small bead of copper, he realised from this incident that malachite, thrown into a fire, becomes a piece of copper.

This is, of course, a possible explanation, but, since the first copper tools of elaborate form have been found in graves of the Gerzean period, which contain many features hitherto unknown in Egypt but, in some cases, clearly introduced from Asia, we may suspect that it was in the latter continent that this knowledge of melting copper first arose. How, when and where, it is difficult at present to suggest, for we know so little of the cultures of South-west Asia except just before the Flood, and the Gerzean period is thought to have begun about three hundred years before that catastrophe, and so rather earlier than the contents of the graves of the first period at Susa. We may imagine, however, that on some occasion a copper tool fell into the fire and became melted, and that the molten metal took the form of the small irregularities or channels in the ashes or the sand that underlay them. This, of course, may have happened on several occasions before an observer noted the occurrence and appreciated its importance.

Once it was realised that copper would melt and that the molten metal could be run into moulds, the art of the metallurgist had been discovered, and, since native copper could nowhere have been abundant on the surface, and other ores are to be found with greater ease, it was doubtless not long before experiments were made with other glittering substances, like chalcopyrite and peacock ore, while an accident with a fragment of malachite may have led, as Elliot-Smith has suggested, to the use of this ore as well for the purpose of extracting the

metal. Once it was learned that tools could be made in moulds, it was possible to enlarge their variety considerably, and to make a number of implements of much less thickness than was possible in flint or stone.

We have seen, then, that copper implements, evidently the result of casting, were known to the Egyptians in the Gerzean period, which began about 4500 B.C., and, it may be added, gold beads as well, while a few centuries later the men of Susa were buried with axe-heads made of a very pure copper. From this time on the art of the metallurgist developed rapidly, the forms of implements and personal ornaments developed into many varieties, and these early folk learned that by hammering the edges of their copper tools they could make them very much harder. We cannot here follow all the developments of the copper industry nor trace the many improvements that occurred until well before 3000 B.C. they had discovered the *cire-perdue* process, by which the pattern is made of wax that is melted and disappears into the substance of the mould when the hot metal is poured in; this process was used in casting the copper lions made to adorn the temple of Ninkurshag, the moon goddess, erected at Tell al 'Ubaid by A-anni-padda, King of Ur. We must proceed to the next metal used, silver.

Silver is, as a rule, found as an impurity in *galena*, an ore of lead, and since the sixth century B.C. it has usually been obtained by treating this lead ore and removing the silver. Sometimes, however, the *galena* has to some extent become decomposed by natural means, and the silver is found lying beneath it in fine threads running into the soil. This is what is called native silver, and it is usually relatively pure. A great quantity of silver is still thus found in the north-west corner of Asia Minor, and was well known there at an early date. About

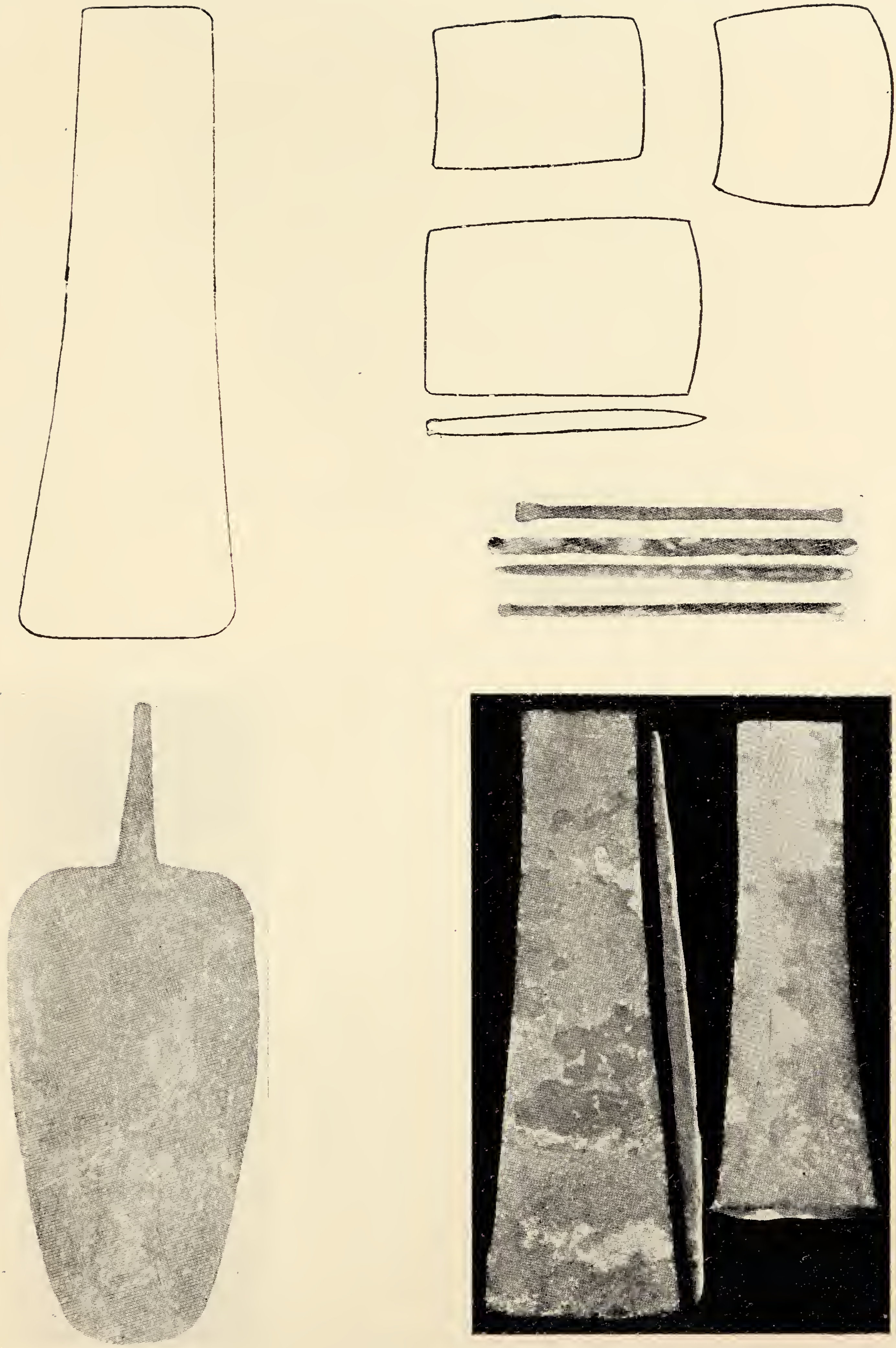


Plate LVII. Early Copper Tools from Egypt

[*Face page* 200

a. Copper lion from Tell al 'Ubaid

b. Silver ornaments of Queen Shubad

PLATE LVIII. EARLY SUMERIAN OBJECTS OF COPPER AND SILVER

2600 B.C. there arose, near the Asiatic shore of the Dardanelles, a great city, surrounded by a tall brick wall, on the spot afterwards occupied by Priam's Troy. This, the second settlement found on that site, now known to the Turks as Hissarlik, is known as the Second city of Troy or of Hissarlik. This Second city was clearly a great trading centre and a place of considerable wealth, and, as it stood at no great distance from the greatest silver producing area in the Old World, it is assumed that this precious metal was one of its sources of wealth. We are, in fact, left in no uncertainty in this matter, since in a hoard of metal objects, that had been concealed before the final destruction of this city about 1900 B.C., were many objects of bronze, a few of silver, a number of gold, and six ingots of silver of exactly the same weight.

These ingots must go back nearly, if not quite, to 2000 B.C., and at least four centuries earlier a group of Babylonian merchants settled in Cappadocia in the middle of Asia Minor, had been engaged in trading in a number of the commodities produced in that region, and among these one of the most important was silver.

This, however, is not the first occasion that silver was known in Babylonia, for silver ribbons adorned the hair of the attendants slain to do honour to the funeral of Queen Shubad, the date of whose death is much disputed. It is agreed, however, that it occurred at some date between 4000 and 3000 B.C., and the present writer has argued more than once that it took place far nearer the former than the later date. A tall silver vase from Telloh, in Babylonia, dates from about 3100 B.C.

Gold, silver and copper are all found native, that is to say, in a pure state, with little or no impurities, and the ores of copper most frequently used shine with a

metallic lustre, or are very conspicuous by their bright green colour as in the case of *malachite*. It is otherwise with tin, which in the state most generally used is a dull dark stone called *cassiterite*. This ore would not readily attract attention, it is not so readily reduced to the metallic state as copper, and tin by itself would have had little value to early man. It is strange, therefore, that a use for it could have been found at a fairly remote time.

Copper ores are found in many places, widely distributed over the area throughout which early civilization arose. Tin, however, besides being less conspicuous, is much less commonly found. It occurs in Cornwall, in Brittany, in several districts in Spain, Southern France, Tuscany and the Erzgebirge, in Bohemia. It was found also in the Taurus Mountains, in the South-east of Asia Minor, apparently in association with copper; it is believed to have occurred in the Caucasus, though this is uncertain, and it is found also in Khorasan, South Africa and the Malay Peninsula.

Tin was first used to mix with copper to form the alloy known as bronze. The addition of 5 per cent. of tin, or even less, to copper produces a material rather harder than either of the constituents. When the proportion of tin reaches 8 per cent. the alloy becomes brittle, but when 10 to 12 per cent. is added the alloy melts more readily, and fills the mould more completely to the exclusion of the gases that had caused bubbles to occur in copper. It had not been easy to cast copper in closed moulds, and the usual practice had been to use open moulds, in which only flat articles could be cast, though in Mesopotamia the workmen of A-anni-padda had apparently overcome this difficulty as the copper lions found at Tell al 'Ubaid testify. With a 10 or 12 per cent. bronze it was possible to use a closed mould,

generally made of two halves bound together with strings; thus, when the use of bronze had become well known, it was possible to cast objects of far more complicated form than had been previously possible, and new and elaborate shapes were developed in the tools, weapons and personal ornaments produced.

How, when and where the discovery was made that the addition of tin to copper would produce this useful alloy is uncertain, but it is believed that the discovery was accidentally made. Ores of tin and copper are found in association in a few districts only; these are Cornwall, Spain, Bohemia and the Taurus Mountains. Each of these places has in turn been suggested as the site of this discovery, but a few years ago Professor Gordon Childe made out a very strong case for the Erzgebirge, in Bohemia. It had long been realised that the earliest bronze implements known were those in a hoard found by Schliemann in the second city on the site of Troy. This city was twice rebuilt, and was destroyed, it is believed, about 1900 B.C., or perhaps a little earlier. The hoard was found in such a situation as to show that it had been concealed during the third phase of this city, at some time, that is to say, between 2200 and 1900 B.C. Childe showed that objects from this city had been carried up the Danube basin and into Bohemia, and suggested that there had been an active trade between the Dardanelles and this part of Central Europe. He suggested that the people of Hissarlik II, the second city on the site of Troy, had been searching for copper throughout Central Europe and that in the Erzgebirge they had found a copper ore, mixed with *cassiterite* or tin ore, and had smelted this, thereby producing accidentally an alloy of much greater value than the pure copper that they had been seeking. This view was corroborated by the fact that about this time

a civilization, known as the Aunjetitz culture, arose in Bohemia, and that in this civilization the production of bronze implements was a striking feature.

Professor Childe's view was readily accepted, and it was agreed that bronze had been discovered by accident in the Erzgebirge Mountains by agents from Hissarlik, who had gone thither in search of copper between 2200 and 1900 B.C. This view, however, received a rude shock when Mr. Woolley found at Ur those famous death-pits which date from between 4000 and 3000 B.C., to which reference has already repeatedly been made, for in the grave of Queen Shubad he found a metal bowl, which, on analysis, proved to have been made of a 10 per cent. bronze. It is known now that bronze objects are not uncommon in Mesopotamia from layers that date from before 3000 B.C., but are rare after that date. From this it has been argued with much justice that the Sumerian people of Mesopotamia had been using a copper ore, in which tin also occurred, without realising its impurity, and that when this source was no longer available they had to fall back on other ores of greater purity. It seems, however, that they had realised that some essential ingredient was lacking, since they had been adding lead and other materials to their copper, endeavouring to produce the hard alloy that they had formerly possessed. It is uncertain from what source the Sumerians obtained the mixed ore, but since both copper and tin ores are found together in the Taurus Mountains, it seems likely that it was from that quarter that they drew their supplies.

The chief ore of lead is *galena*, which is found in considerable masses in many parts of the world and is by no means uncommon. It has a dull metallic surface and must at an early date have attracted notice, but it was not much used, for it was too soft to make serviceable

tools and too dull in colour to be attractive for ornament. As we have seen, it was used at an early date in Mesopotamia as an unsatisfactory substitute for tin, but in later days it was sometimes mixed with copper to make a more pliable alloy than bronze. Since it melts at a low temperature, it was occasionally used for making small figures, but, as it readily becomes crushed or dented, it was not extensively employed for that purpose. The Athenians discovered a method of extracting silver from the lead ore dug from their mines at Laurium, and the Romans used this metal extensively for making pipes to conduct water about their villas.

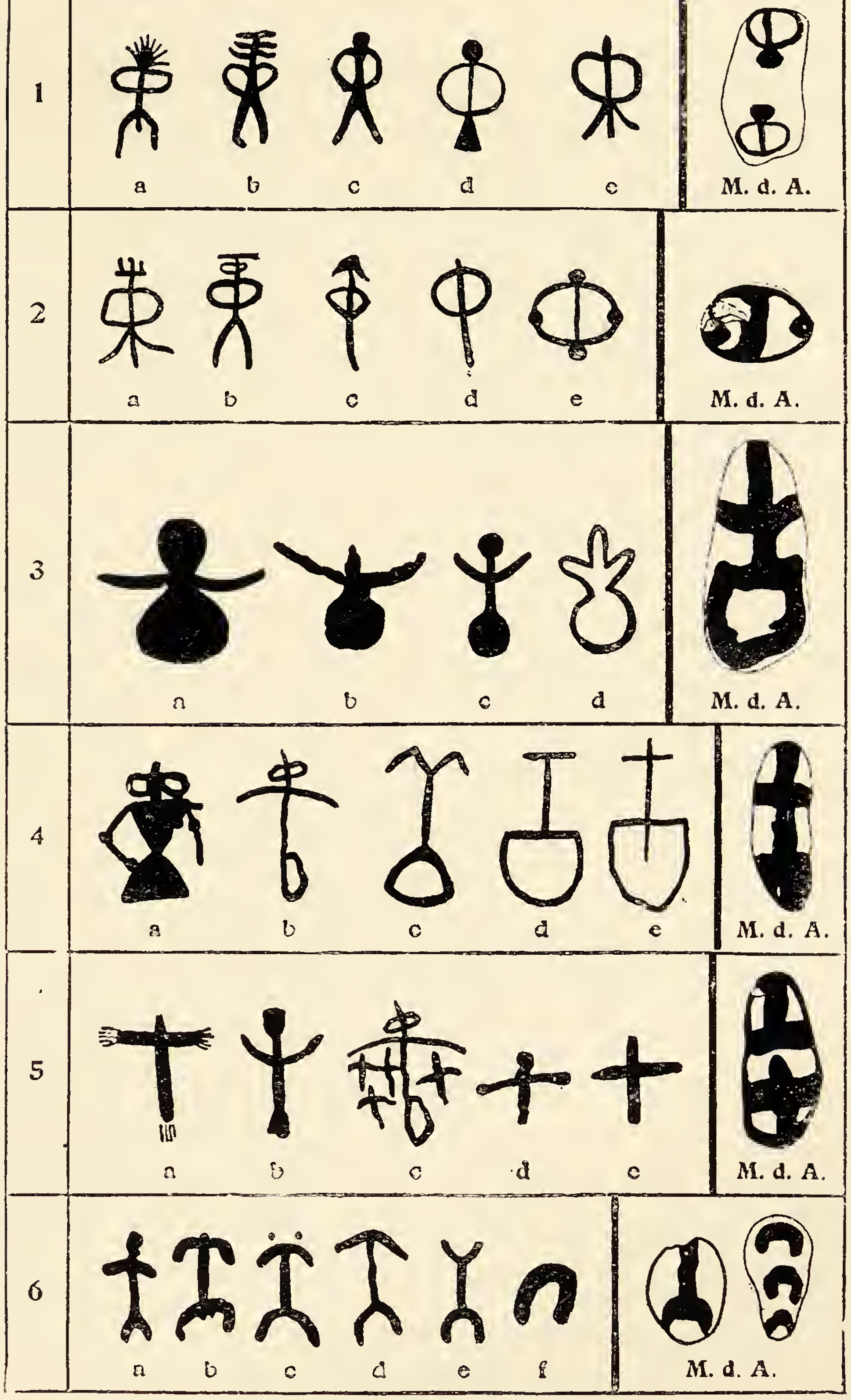
Mercury was prepared as early as 300 B.C. by the Greeks, who knew it as *hydrargyrum*. It was obtained chiefly from *cinnabar*, a bright scarlet ore that had been used at a much earlier date for paint. There is a large deposit of *cinnabar* near Vinča, on the Danube, near Belgrade, and this was used for painting pottery as early as 3000 B.C. Iron did not come into general use until a comparatively late date, and the history of iron working is sufficiently important to require a chapter to itself.

CHAPTER XX

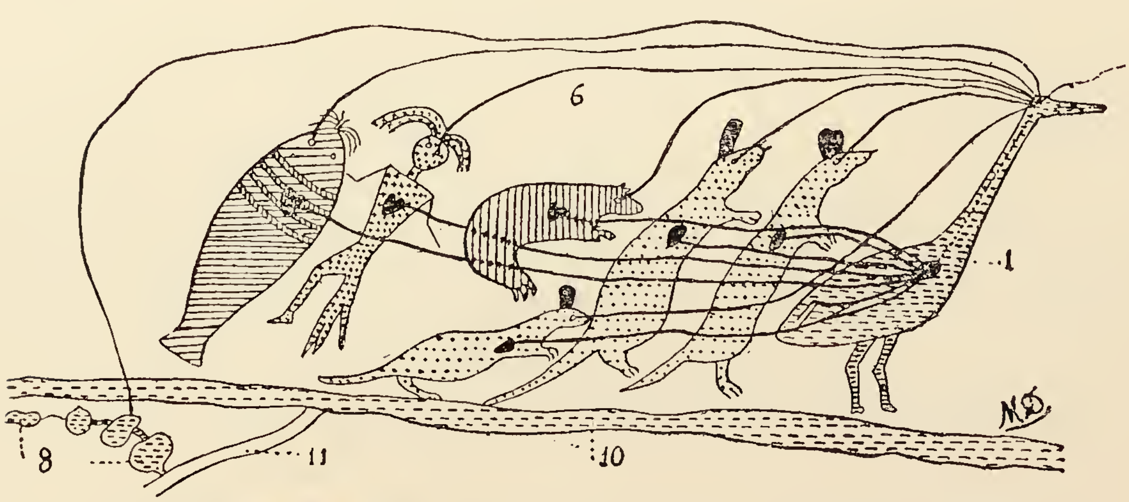
THE INVENTION OF WRITING

In endeavouring to ascertain the origin and to trace the early development of a number of human activities, we have noticed that some of them were of fundamental importance, and led to considerable advances in the standard of living; among these we may cite the first fashioning of a tool, the discovery of a method of producing fire, the first effort to domesticate an animal and the production of crops of grain. These all led to a great improvement in the life of those who made these discoveries or had learned these arts from others; they were followed by a host of minor discoveries, some of which ultimately became of equal, if not greater, importance. Another discovery, in many ways greater than those already mentioned, was a method by which communications or orders, hitherto always made by word of mouth, could be conveyed to some one at a distance, and could be preserved so as to convey information to those living at a later time. This, the invention of a method of writing, only reached its full development when truly civilized communities arose, yet its humble origins go back to a fairly early date.

We have seen in a former chapter how in the Upper Palæolithic Age the hunters painted and engraved on the walls of caves and rock shelters wonderful pictures of the beasts they hunted, and how in the succeeding Mesolithic Age this art declined and the representations of animals became conventionalised. On many of



a. Spanish petroglyphs



, blue. . red . ochre. . brick red. . green. . black

b. North American picture writing

PLATE LIX. PICTOGRAPHIC SCRIPTS

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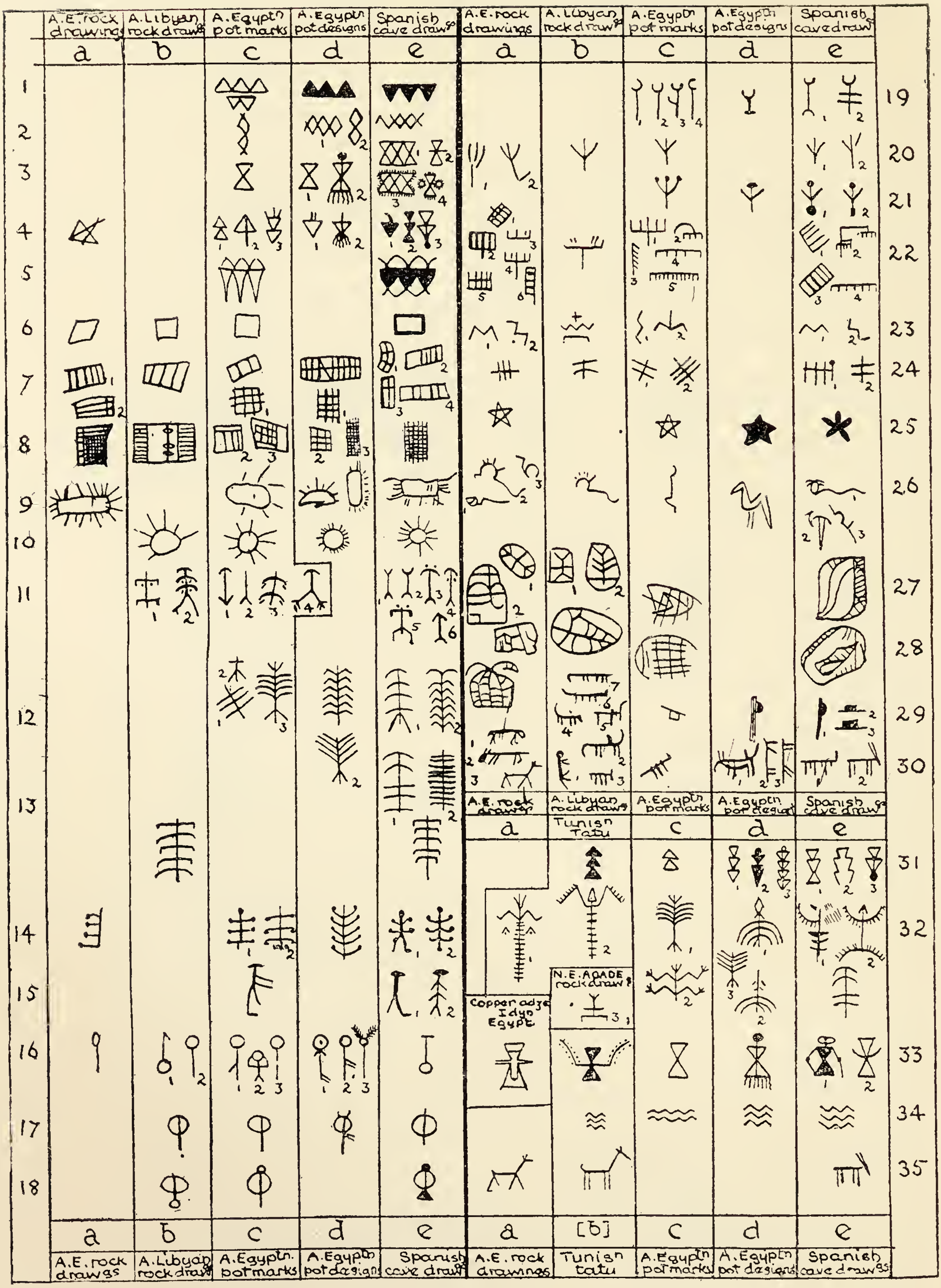

Plate LX. North African and Egyptian Conventional Signs

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the rock surfaces in Eastern Spain a number of these conventionalised pictures have been found, dating from the Mesolithic Age. Some of these clearly are intended to represent the human figure, while others have degenerated into purely conventional signs. Similar signs have been found painted on pebbles in the cave of Mas d'Azil, in the South of France, and others like them have been reported from Switzerland. Conventional signs, almost exactly like those from East Spain, have been found engraved upon rocks in North Africa, and identical signs have been recognised painted upon pots of the Early or Amratian phase of Predynastic Egypt. Doubtless these signs, like the cave paintings, were originally drawn for magical purposes to ensure an abundance of game or success in the chase, but on the predynastic pottery in Egypt they seem to have been used as ownership marks, for the identification of personal property. Though these signs had almost certainly no phonetic value, and probably no precise meaning, still, if they were used as marks to identify property, they were conveying information and so, in some sense, they were a simple form of writing.

The earliest form of writing seems to have consisted of drawing rude pictures for the purpose of conveying information to some one at a distance, or who was expected to arrive at the picture at a later date. Rude pictures, sometimes intended to show the way the hunting band had gone, or to register some agreement as to the partition of hunting territories, are made by some backward peoples, and were often drawn on bark by some of the Indian tribes of North America.

For many years past there have been found in Mesopotamia a small number of baked clay tablets, on which were incised representations of objects; these were believed to be some early form of writing, but it was uncertain

to what date they should be relegated. This uncertainty continued for several years, for no such tablets had been found at Ur, while those discovered at Kish had certainly been derived from an earlier deposit. In 1927, however, Mr. Mackay excavated a deserted village at Jemdet Nasr, about seventeen miles to the north-west of the site of Kish, and here he found a quantity of pottery, decorated in many colours, the chief of which was a reddish purple, and here, besides a quantity of grain, he found several of these tablets, covered with pictures or pictographic script, and in close association with the pottery. Later on, in 1929, while sinking a deep hole at Kish, the excavators found deposits laid down by successive floods. The lowest of these, which Langdon has dated at 4200 B.C., seems to be the Flood of tradition, described in the Book of Genesis, and just below this flood layer was another containing a quantity of fragments of polychrome pots, just like those found two years earlier at Jemdet Nasr. The pottery of Jemdet Nasr, therefore, dates from before the Flood and from some centuries earlier than 4000 B.C., and the tablets containing the pictographic script are of equal antiquity.

Professor Langdon believes that he has succeeded in reading some of the words depicted on these tablets, and he says that they are in the Sumerian language, so that we must credit this people, who seem to have arrived in Mesopotamia not very long before, with the introduction of the earliest form of writing that we know, unless we consider the conventional signs used by the Mesolithic inhabitants of Spain and North Africa to be the germs of a true script, which is very uncertain. Professor Langdon tells us that the pictures on the tablets from Jemdet Nasr are undoubtedly ancestral to the characters used later by the Sumerians, and which

continued to be used in Mesopotamia almost down to the beginning of our era.

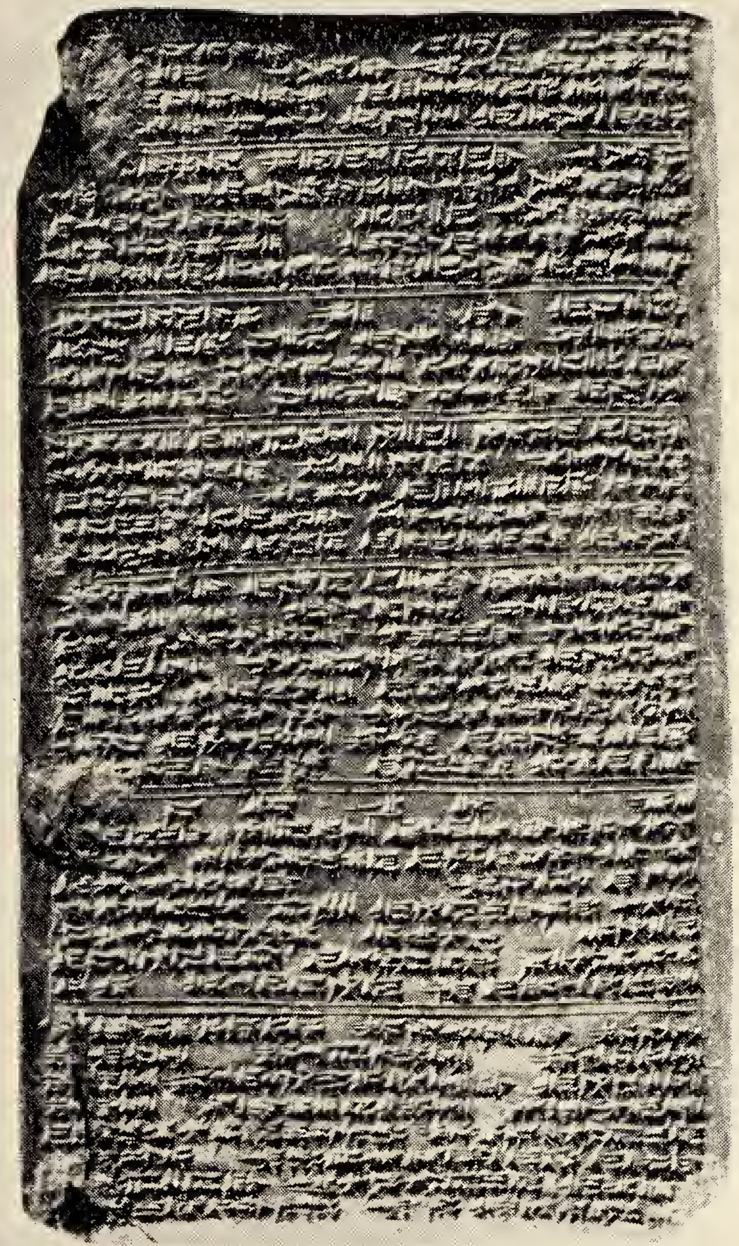
The writing used in Mesopotamia is called the cuneiform script, because the characters were impressed upon the soft clay by a *stylus* or pen with a triangular section, which made a wedge-shaped mark. Thus the characters are formed of a number of small wedge-shaped impressions, arranged in patterns, which are a simplified form of the original picture; after this had been done the clay tablet was baked in an oven, producing what was in effect a little inscribed brick, quite hard and almost indestructible. By this means a large number of these tablets, ranging over a period of nearly four thousand years, have come down to us; by the skill of a number of scholars these can be read and translated, and from the quantity that have been found and read there has been restored to us an almost complete history of that country during the period that such writing was in use.

The earliest Sumerian cuneiform characters resembled the original pictures as closely as it was possible to make them with wedge-shaped strokes, but by degrees we find these characters become simplified and written with fewer strokes, thus becoming less and less like the original picture. The Sumerians used the signs to signify objects, ideas or actions, but when the characters became used by the Babylonians and Assyrians they acquired phonetic values and the signs represented syllables. Thus a star-like sign signified "heaven" in the Sumerian language in which the word was *an*. In Babylonian, however, the sign ceased to mean "heaven," but was used for the syllable *an*, either alone or in combination. Similarly another simple sign in Sumerian signified "water," which, in that language was *a*. In Babylonian it was used, followed by another sign, for *a-bu*, which means "father." Thus the signs gradually changed from

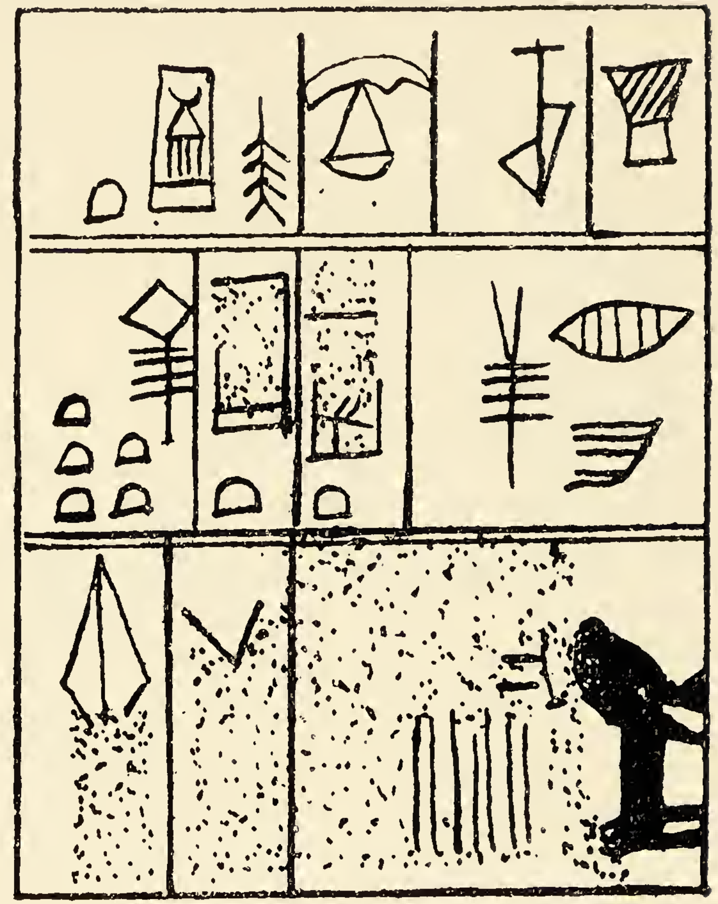
conveying the meaning of an object or an idea to conveying the sound of a syllable.

We have seen already that certain signs, used probably for magical purposes by the Mesolithic inhabitants of Spain and North Africa, were employed by the Predynastic Egyptians of the Amratian period as marks to identify their property. We have little more evidence of anything like writing in Egypt until the closing phase of the Late Predynastic or Semainian period, when we find very short inscriptions, usually the name of a king, on some of the objects buried in graves. Here again the writing seems to have been used mainly for the identification of property.

The early Egyptian writing, like the earliest found in Mesopotamia, was a form of picture writing, known as hieroglyphic. It was not, however, copied from the Asiatic form, since, as Newberry has shown, many of the signs were derived from plants that only grew in the Delta of the Nile. As we have seen, there is good reason for believing that the people, who introduced into Egypt the essential features of the Middle Predynastic or Gerzean period, had come from South-west Asia and had settled first in the Delta, and it seems possible that they had brought with them the idea of picture writing, which appears to have superseded the simple proprietary signs used on the Amratian pots. This picture writing or heiroglyphic continued in use in Egypt for many purposes until the country was conquered by the Romans, and was not wholly abandoned until the Arab conquest. The signs were sometimes carved on stone and at others painted on plaster, or on a substance made from the pith of the papyrus reed, pressed and dried to form a kind of paper. Since, however, it took considerable skill and some time to carve or paint these characters, a simplified form was evolved by the priests from the



a. Cunieform tablet from Mesopotamia



b. Pictographic tablet from Jemdet Nasr

PLATE LXI. MESOPOTAMIAN SCRIPT

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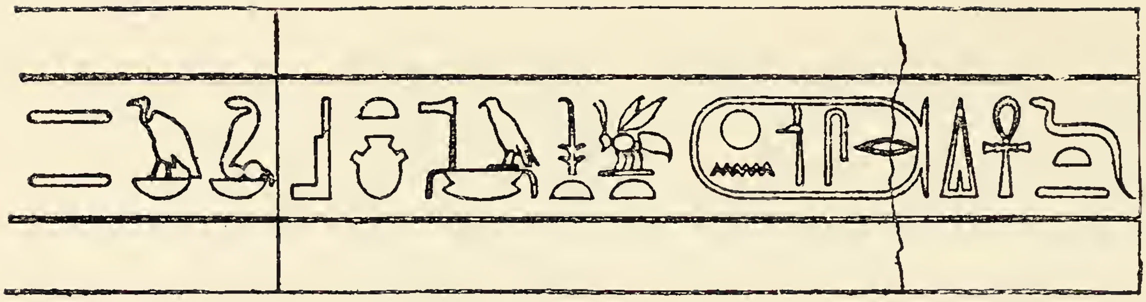
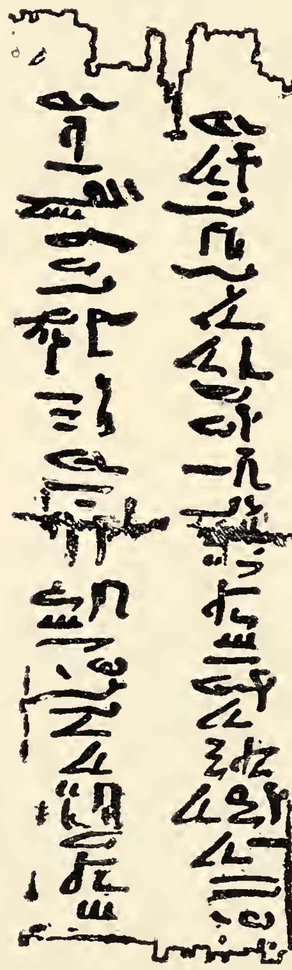
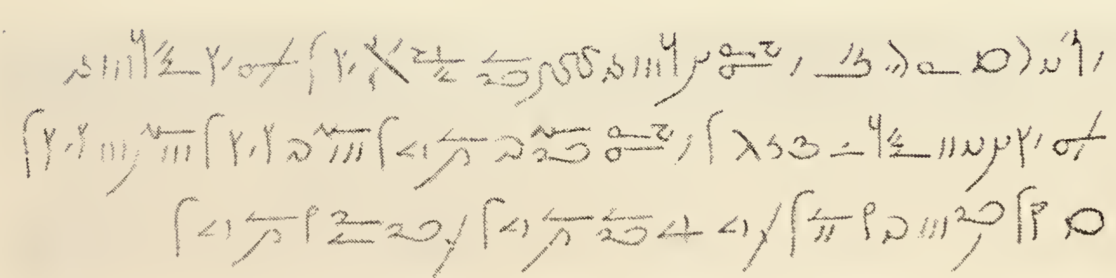


a. Hieroglyphic script



b. Hieratic script



c. Demotic script

PLATE LXII. EGYPTIAN SCRIPTS

hieroglyphic. This is called the hieratic, and this could be written with a reed pen upon linen or papyrus. In later days a still more simplified and cursive script was developed for the use of the laity: this is known as the demotic script. Though at first, as among the Sumerians, each sign represented an object or an idea, later on the signs acquired also phonetic values.

Thus in two of the most civilized countries of antiquity there arose two systems of writing, both based upon pictures. In one of these, in which the signs were painted on wood or plaster, or engraved upon stone, the signs retained their pictorial form; in the other land, where the signs were usually impressed on clay tablets, which were subsequently baked, the pictures soon became conventional signs, composed of a number of straight wedge-shaped lines. In both cases the signs stood for things and actions, and in both cases they ultimately acquired also a phonetic value and stood for syllables.

Very similar systems of writing arose in other parts of the world, in some cases at a fairly early date, though in no case can it be shown that they began as early as by the Nile and the Euphrates. One of the earliest and best known of these systems is that employed to this day by the Chinese and borrowed from them by the Japanese. That this system arose from a primitive picture writing is generally agreed, for many of the signs, such as those for "man" and "tree," still show some resemblance to the original picture. The Chinese, however, have a tradition that at first notched sticks and knotted cords were used, probably to record numbers, while early signs were copied from the foot-prints of birds and beasts or from the markings on the shell of the tortoise.

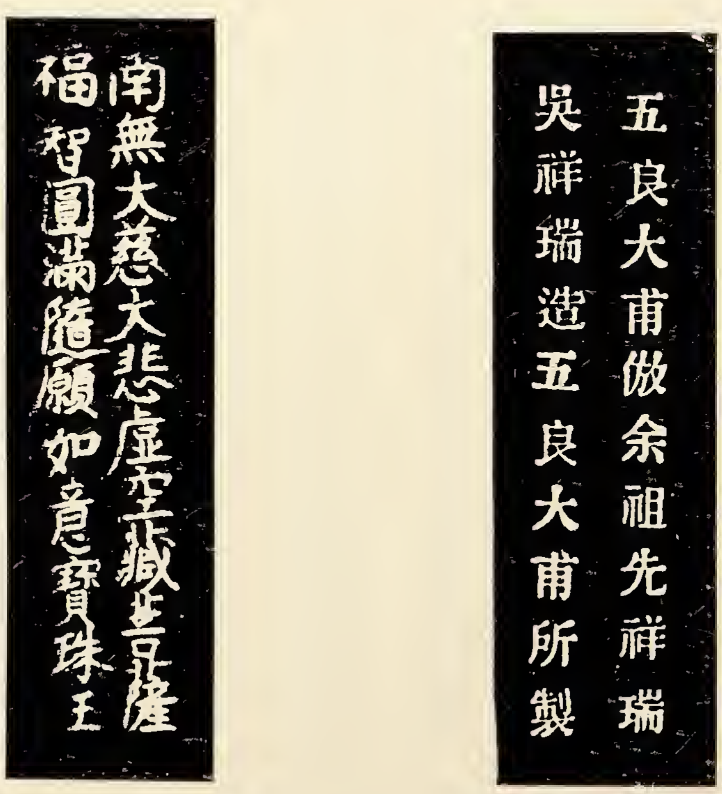
Though these signs were originally derived from pictures, they are widely different to-day, and have been

so as far back as we are able to trace them. Like the Sumerian signs used in Mesopotamia they are composed of a number of lines, but these are not straight wedge-shaped lines, but usually have a slight curve. Like the Sumerian signs, however, they are usually thicker at one end, tend to taper to a point at the other, though this is not invariably the case. It has been suggested that the curve in the lines resulted from an early practice of cutting the signs on slips of bamboo; this is likely enough, since it is known that this material was in frequent use for this purpose, certainly up to 500 B.C.

Chinese tradition asserts that the earliest picture writing was invented by one of their emperors, Fu Hsi, who reigned from 2852 to 2738 B.C., but the very existence of this early monarch is in doubt. The earliest positive evidence that we have of this writing comes from the ruins of a city, built and occupied during the reign of the Shang or Yin Dynasty, which ruled in China from 1766 to 1122 B.C. At the site of this city, An-yang in Honan, there have been unearthed recently a number of tortoise-shells, deers' antlers and the shoulder blades of sheep, on which short sentences have been inscribed. These fragments of writing, which are usually magical *formulæ*, have been found recently in large numbers. The signs on them are almost as distinct from the original pictures as those of to-day, so that we must conclude that they are not the first attempts at writing, yet these early specimens from An-yang must go back at the lowest estimate to 1122 B.C.

Each of these signs stands for a thing, an action or an idea, and in practice for a word, and fresh signs are constructed out of two or more others to stand for a more complicated conception. Some of the simpler signs are occasionally used phonetically for a syllable, and this practice is increasing, especially in Japan,

a. Shoulder-blade of sheep, with early Chinese inscription from An-yang



b. Chinese characters

PLATE LXIII. CHINESE SCRIPTS

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[By Courtesy of Prof. John Garstang

a. Hittite hieroglyphs

b. The Phaestos disk

Plate LXIV. Phaestos and Hittite Hieroglyphs

where such signs are thus used for proper names. The Japanese have also two syllabaries, known as the *katagana* and the *hirakana*; these, which consist of a consonant each followed by a vowel, are used by the less literate folk and for transcribing foreign words and names.

Another form of what is believed to be picture writing has been discovered on several stone monuments in Syria and in parts of Asia Minor. Since these regions are known to have formed part of the Hittite empire, it is assumed that their hieroglyphs were the work of that people. No one has yet succeeded in deciphering these inscriptions, so it is impossible to fix their date. The Hittite empire flourished between 1900 and 1200 B.C., so we must believe that the monuments were erected during the intervening centuries, and it has been suggested, though without much evidence to support it, that their date is about 1400 B.C.

The strange disk, covered with hieroglyphic signs, found at Phaistos in Crete, stands alone and has not been deciphered. It dates from the closing years of the Middle Minoan period, just before 1600 B.C., and is clearly not of Cretan origin. It is believed to have come from Lycia or some other place on the southern coast of Asia Minor.

Lastly we have the picture writing found on the ancient monuments in Central America. These signs are much stylised but have hardly become truly conventional. Their origin is much disputed and it seems likely that most of them, at any rate, do not date from before the early centuries of our era.

It will have been seen from the foregoing remarks that a number of different styles of writing, all based upon picture writing, arose in various parts of the world. Each of these developed independently and may have arisen from a similar desire to convey information other

than by word of mouth. Alternatively the idea of picture writing may have arisen at one place among one people, and this idea may have been borrowed by others, who proceeded to develop it along their own lines. There seems to be little doubt that the first to make attempts at this means of expression were the Sumerians. These systems have much in common, for in all each sign represents an idea or a word, though in most of them some of the signs ultimately acquired a phonetic value and came to signify the sound of a syllable.

About 1400 B.C. the empires of the Near East, which had been carrying on ceaseless warfare among themselves for two centuries, began to try to settle their differences by diplomatic methods. This led to constant correspondence between their chancelleries, and we are fortunate in having discovered archives of this date in Egypt and Asia Minor. As a rule the Babylonian script was used for this correspondence, though letters are found in the languages of the various powers. At the same time there was much international trade going on, especially in the eastern part of the Mediterranean Sea. The kings and statesmen could employ learned scribes, capable of reading and writing in various languages; not so the small traders of the coast. So it was that various attempts were made to produce a simplified writing, capable of being used in any language for recording sales and purchases, and for making inventories of goods and bills of lading. Some attempt seems to have been made in Syria to construct this out of the Babylonian script, and this appears to have enjoyed only partial success, while others took some of the simpler hieroglyphic signs from Egypt, and, making them still more simple, used them first for syllabaries, and then for an alphabet, though for a time no vowels were used. The use of such simple signs was first employed in Crete,

perhaps as early as 1700 or 1800 B.C., but the use of such alphabets became more general about 1400 B.C. all over the coasts of the Eastern Mediterranean and even sometimes in the West. By degrees these signs became standardised, and from being syllabaries became an alphabet of consonants, to which vowels were afterwards added.

The first use of such an alphabet has been attributed to the Phœnicians, and in a sense this is true. In later days the term Phœnician became used for the people of Tyre and Sidon, in whose hands lay, for a time, the greater part of the over-sea trade in the Mediterranean region. Before these cities attained to this mercantile supremacy, trade had been largely in the hands of the peoples of Crete and the Cycladic Islands. It seems probable that traditions concerning the early doings of the Phœnicians refer rather to these islanders than to the people of the coastal cities of Syria. It seems likely, then, that it is to the Cretans that we must attribute the first use of an alphabet, and its introduction into Greece and other places in the Mediterranean region, though doubtless, after the fall of Cretan sea-power about 1400 B.C., the Phœnicians carried the alphabet to the Hebrews and to other peoples among whom they traded. Thus by about 1000 B.C. a universal alphabet was in use all round the Eastern Mediterranean, though Egypt and Mesopotamia retained their own scripts until very much later days. At the present time all the literate people in the world, except the Chinese and the Japanese, use alphabets derived from the one that we believe was first developed in Crete.

CHAPTER XXI

THE BEGINNINGS OF TRADE

There was little or no trade done in early times. Each hunter made and mended his own weapons and hunting appliances, while the women made their baskets and leather bags, besides providing the skin clothes for the family. At a later date, when they had taken to a settled agricultural life, the women continued to spin and weave fabrics for the family's clothing and to make their own pots. Sales were unknown and exchanges of objects of everyday use rare or non-existent. Even to-day some of the native women in Algeria make their own pots, decorating them with designs traditional in their family, and such pots were never sold. Should a collector desire one of these, it is necessary to obtain it as a gift, after which a suitable gift in money is taken or sent on the following day.

Some of the early tools, even those dating from the Lower Palæolithic Age, are of such extraordinarily fine workmanship that some have suspected that they must have been made by men who gave up their whole time to the work. This view is supported by the discovery of flaking-floors or workshops, where the great number of flakes and wasters shows that tools were constantly being manufactured on the spot. There is nothing inherently impossible in this. In a hunting community there must have been some who from natural weakness or as the result of an accident were unable to take their due part in the chase. The weaklings probably died early

in these primitive surroundings, but we can imagine that a robust hunter, who had met with an accident causing permanent lameness might sometimes survive the rude surgery of the time, and, no longer able to participate in the chase, settle down as the tool-maker of the community. Thus, perhaps, arose the skilled craftsman, and it is well to remember that Hephaestus, the artificer of the Olympian gods, was a lame deity.

Though skilled craftsmen may have arisen in this way in hunting communities, it seems unlikely that they sold or bartered their wares; it is more probable that they supplied their group with the necessary weapons in return for a share in the feast when the hunt had been successful. We have here, it is true, an instance of specialisation of labour, similar to the difference that had already arisen between men's and women's work, but true trade, in the sense of barter and assessing the respective values of the goods exchanged, did not, in all probability, arise until a later time.

We have seen that in the Mesolithic Age the majority of the people settled down by the sides of lakes and streams, or by the seashore, and lived upon fish and shell-fish. Where the latter were abundant, and there was a plentiful supply of limpets, mussels, clams and oysters, the Mesolithic folk seem to have depended very slightly upon a fish diet. Where, however, these were scarce or absent, they were compelled to develop the fishing industry to the best of their ability, and to contrive some kind of boat. Of what nature were these primitive craft we have discussed in an earlier chapter, but it seems likely that some of these were invented first by Mesolithic dwellers by the seacoast.

It must often have happened that these early fishermen were carried far out to sea by contrary winds and tides, and that, on regaining the shore, they landed on the

territory occupied by another tribe. Each tribe probably possessed something, perhaps a natural substance or else a fishing implement, not possessed by the other, and we can well imagine that exchanges of such commodities were made and afterwards repeated. It is possible, therefore, that as early as the Mesolithic Age some simple exchanges of this nature were carried out, thereby leading to the foundation of trade, though at the moment positive evidence of this is lacking.

The early grain growers were usually very self-contained communities, growing their own food supply and making their houses, clothing and pottery at home. They were not at first inclined to trade, but, when they were able in fertile lands to grow more corn than they required, they were not averse to exchanging this for commodities that were out of their reach, such as salt and precious materials for use as personal ornaments. Few of the early grain-growing communities indulged much in such exchanges, but in Egypt and Mesopotamia, where the soil was exceptionally rich and the harvests correspondingly abundant, we find signs of the exchange of commodities at a very early date.

The Egyptians, having no larger timber, constructed their boats of bundles of reeds, as we have seen, and their craft were only useful for river traffic and were quite unsuitable for sea voyages. They did not, therefore, indulge in early trading ventures, though, as we shall see, they exchanged their surplus corn for commodities brought to them by others from elsewhere. We must not, therefore, look to Egypt for the earliest attempts at trading.

In Mesopotamia the earliest grain-growing people were the makers of the painted pottery, both of the black on buff and the polychrome wares. The remains found from their civilization do not suggest that they indulged in trade. Their country, however, as we have seen, was invaded

some generations before the Flood by another people, the Sumerians, who had a very much higher standard of living. They dwelt in cities, built on raised mounds so as to be safe from floods, and these cities were surrounded by walls of baked brick; they had invented also a form of picture writing, impressed on clay tablets. Such a standard of living is scarcely compatible with that of a purely agricultural community, and only a few generations after the Flood we find the graves of kings and queens containing a wealth of objects in silver and gold and lapis lazuli, none of which were to be found near at hand, and we can only conjecture that these people were well advanced in commerce before they settled at the head of the Persian Gulf.

The Sumerians, as we have seen in a former chapter, seem to have lived somewhere on the coast of the Persian Gulf, probably near its mouth. Their original home, known to them in later days as Dilmun, was a district that exported dates, while before their arrival in Mesopotamia they had been accustomed to decorate objects with inlaid shell, an art still practised in the Bahrein Islands. Their original home must, therefore, have been in or near these islands, or more probably on the coast of the plain that surrounds Bander Abbas on the Straits of Ormuz, for in this district the date palm still grows in abundance.

It is very doubtful whether in their original home they were growers of grain, though they readily took to agriculture after their arrival in Mesopotamia. In their early home grew great groves of date palms, the fruit of which is a most sustaining food. The shallow waters of the Persian Gulf are rich in molluscan life, and quantities of shell-fish could readily be obtained without much labour. It was in such surroundings that we must believe the early Sumerians to have developed their culture while still in a Mesolithic state.

It was during this time, we believe, that the Sumerians constructed the first keeled boats, the ancestors of our modern ships, and in these they were able to go farther out to sea, in search of fish. How they fished we do not know, but they may well have used nets, and with the fish have sometimes dredged up pearl oysters, which are still plentiful in these waters. Unlike most other Mesolithic folk, who would have eaten the oysters and cast away the shells, they noted the mother-of-pearl lining, and saw in it possibilities for decoration. Then began that custom of shell inlay, which they continued to use long after their arrival in Mesopotamia, and it is not fanciful to imagine that they saw in this substance, and the decorated objects that they made from it, a commodity that could be exchanged with tribes, living inland but possessed of other goods that they lacked. We can hardly doubt, too, that they found pearls also, and that these were exchanged for rarer or more numerous goods with the inland peoples. Thus it seems possible, and even probable, that the early Mesolithic Sumerians of Dilmun acquired a habit of exchanging pearls and objects decorated with mother-of-pearl inlay with peoples unable otherwise to procure these luxuries, receiving in return some other and to them inaccessible commodities.

When their keeled boats had been developed the Sumerians doubtless made considerable voyages with the object of exchanging their goods, and on some of these reached the head of the Persian Gulf, where they found a humble people, cultivating wheat and barley and making several kinds of painted pottery. At first, no doubt, they were content to exchange their pearls for grain, but since, having acquired a taste for bread, they required more grain than their small boats could well carry, they moved up by degrees, and settled at the head of the Persian Gulf, and beside the lower waters of the Tigris and the

Plate LXV. Gold Head-dress from the Tomb of Meskalem—dug at Ur

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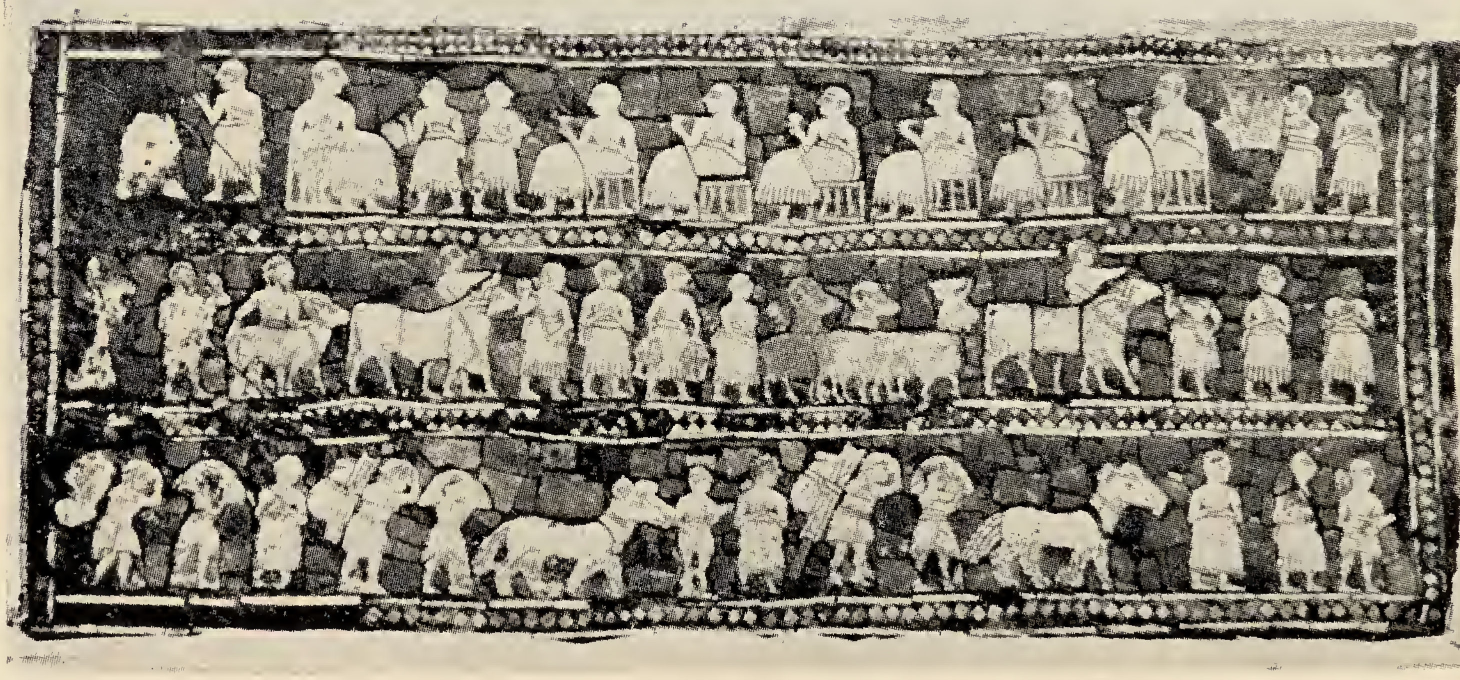

Plate LXVI. Sumerian Shell Inlay

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Euphrates. This movement had taken place some generations before the Flood, which we are disposed to date at about 4200 B.C.

One of the oldest and most important of the cities of the Sumerians was Ur, which lay at the head of the Persian Gulf, and at the mouth of the Euphrates. From here it was possible to trade down the Gulf and into the open sea beyond, and by coasting to reach Egypt on the west by means of the Red Sea, and the mouth of the Indus on the East; it was also possible to utilise river traffic up the Euphrates and Tigris. More than this there is a long narrow valley with steep sides running diagonally half way across Arabia. Through this valley, the Wadi Armah, runs a trade-route, which seems to be of immemorial antiquity; this valley opens out towards the Persian Gulf at no great distance from Ur. This city was, then, admirably situated for trading in every direction, and we can well understand how it became the headquarters of an early trading community, sharing its commerce with a number of other Sumerian cities similarly situated up the river but at no great distance from the gulf.

It seems unlikely that the Sumerians, who had had an ample food supply of fish, shell-fish and dates, readily obtainable with little labour, would have exchanged this leisurely existence providing ample time for profitable trading ventures, for the hard life of the grain grower, who is forced to cultivate the ground in the sweat of his brow. It seems more likely that they moved to the head of the Gulf to obtain better centres for trade and to secure an ample supply of grain from the people already in occupation of the soil. Thus we find here, already before the Flood, a country possessing two sections in its population, one agricultural and the other commercial, with pastoral tribes with their flocks and herds on the margin of

the desert nearby. These commercial communities grew rapidly in wealth and luxurious living, and only a few centuries after the Flood we find their kings and queens buried, with ghastly rites, accompanied by vast quantities of gold, silver and lapis lazuli, imported from foreign lands.

Let us now return to Egypt, where corn had been grown since Badarian times, if not before, and where the people had been able to ascend and descend the Nile in small boats. Here there is at first little or no sign of trade, except that the people used powdered malachite for painting their eyes, and must have obtained this from the desert of Sinai just beyond their borders. At the beginning of the Middle Predynastic or Gerzean period many of the people were buried with beads of gold, lapis lazuli and other precious materials, and imported commodities become more abundant as we advance, until before the close of the Predynastic period a large number of foreign imports were reaching the Delta. As we have seen, it seems unlikely that the Egyptians with their reed boats could have engaged in this foreign trade, but the soil of the Nile Valley is very rich, and is fertilised anew each year by the river's floods, so there was always corn in Egypt, enough and to spare, and other traders, having stones, precious and otherwise, to barter, brought their goods by sea to Egypt and returned laden with grain.

There were other centres at which trade arose in early days, all of them by the sea coast and many of them on islands. On the site of the Palace of Knossos in Crete, Sir Arthur Evans found a deposit many feet in thickness, composed of broken pottery that dated from a time in which metal was unknown. How early this settlement began we can form no idea, but it was certainly in existence for many centuries before 3400 B.C. Such a vast accumulation of fragments of pottery denotes, not

only that the settlement had lasted for a very long time, but that a great number of people had been living there. Large numbers of people cannot conveniently live in one settlement if they are engaged in agriculture, for some of them would be too far from the fields that they cultivate. We must assume, therefore, that like those living there at a later date, a considerable number of the inhabitants were engaged in industry or commerce. What they exported is uncertain; in later days their chief export was olive oil, but in these early days the olive had probably not been introduced. The exports can scarcely have consisted of grain, for the cultivatable land is neither very extensive nor remarkably fertile, still less can it have been metal goods, since metal was then unknown and the deposits of copper ore in the island are neither numerous nor rich. Still there is little doubt that some of the Neolithic inhabitants of Knossos must have been engaged in oversea trade, and one can only imagine that they were intermediaries in a traffic between two other regions that needed to exchange their surplus commodities.

North of Crete lie the group of islands known as the Cyclades and some of these contain substances much in demand in Egypt and other countries. The island of Melos has large supplies of obsidian, a volcanic glass, from which the finest tools were made until it was surpassed by bronze, for an obsidian tool was sharper and more serviceable than one of copper. Paros has great deposits of white marble, which was used in Egypt, even in Predynastic times, for stone bowls and jars. These stone bowls were made by making numerous holes in the material with the aid of drills tipped with emery, and the only readily available source of emery in the ancient world was the island of Naxos, another of the Cyclades. Thus this small group of islands in the Ægean Sea could provide at least three materials which were lacking yet much in

demand in Egypt and other countries. The valuable resources of the Cyclades seem at first to have been exploited by the people living on the south-west coast of Asia Minor and perhaps by the inhabitants of Knossos, but soon a population arose in these islands, who carried on an extensive trade to the north and south. We have evidence of their activities in the Black Sea, since beads of their manufacture have been found in South Russia, and we suspect that they sailed up the Danube as far as the Iron Gate, and traded with the Transylvanian goldfields, since gold, containing an impurity only found in the Carpathian region, found its way to Egypt by 3000 B.C., carried thither, it is believed, by Cycladic merchants.

We cannot pause here to enumerate all the early trading centres, though these were invariably by the sea, and, except those in the Persian Gulf, almost all in the Eastern Mediterranean. One of the best known of these trading centres was the second city on the site of Troy, which lay a few miles from the Asiatic shore of the Dardanelles, and which seems to have carried on an extensive commerce both by sea and by land between 2600 and 1900 B.C.

Though many peoples had entered on a life of commerce, the Sumerians still kept in a leading position. As early as the time of Sargon, who was king of Agade from 2752 to 2697 B.C., their activities had reached the Mediterranean shore in North Syria, and they were obtaining tin from Ku-ki, which was probably the region of the Taurus Mountains, and had oversea commerce with Caphtor, by which name Crete was known to them. A few years later, about 2600 B.C., they had made settlements in South-eastern Asia Minor, where they formed trading communities without endeavouring to rule the land. Later, on the formation of the Hittite empire about 1900 B.C., they formed another such community at the Hittite capital, Khattussas, later known as Pteria, and now as Boghaz

Keui, a city which lay near the curve made by the Halys River in the centre of Asia Minor. These Sumerians in Asia Minor were solely trading communities, living under the rule of Hittites and others, much as Jewish communities have lived for the last two thousand years in the leading cities of Europe, Asia, Africa, and in recent years, of America.

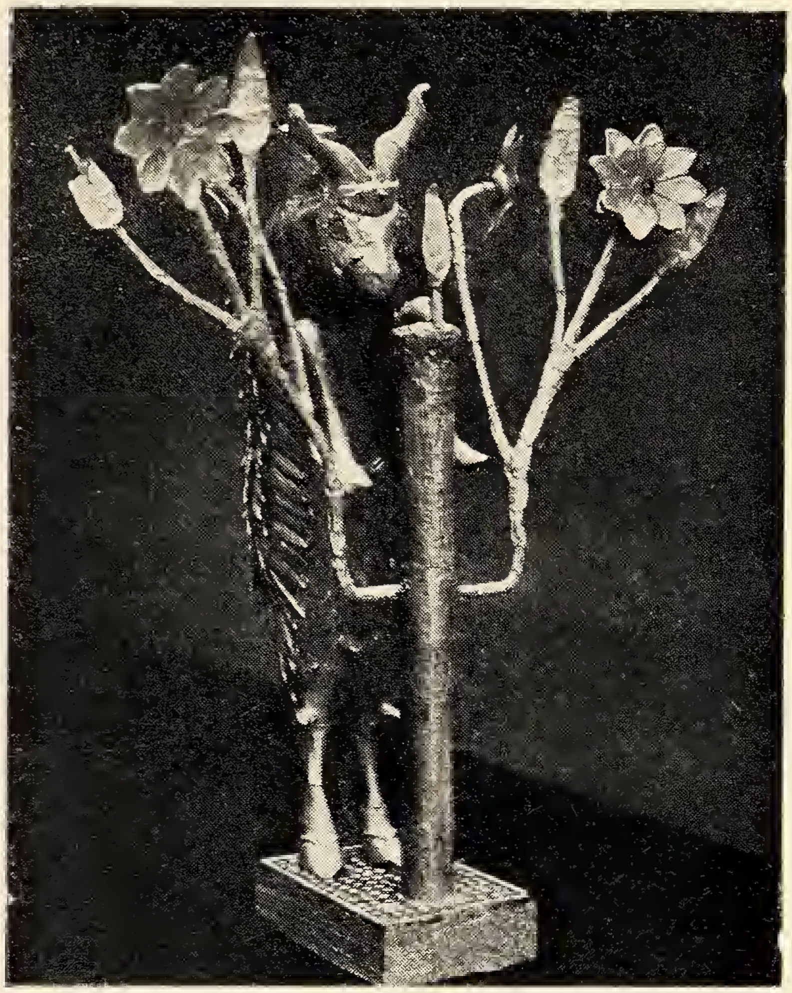
It is clear that if trade was to develop beyond mere barter, it was necessary to have some standard by which to assess the relative values of different categories of goods. This necessitated a system of weights and measures. Various peoples in antiquity adopted some such standards, but the Sumerians seem here again to have been first in the field, and their weights seem ultimately to have been adopted, under different names, by most other traders. The first medium of exchange seems to have been barley, which was measured by the *gur*, but before 3000 B.C. copper and silver were also used, and articles could be valued alike in silver or barley. For foreign trade, however, silver was far more convenient than barley, since it conveyed a greater value with less bulk. After a time gold, being a still rarer metal and so of more value, came into use for larger transactions, but both metals were used for this purpose, though their relative values changed from time to time. Thus in the time of Sargon gold was worth ten times as much as silver, in the eighth year of Bursin, 2337 B.C., it was worth eight, and in the thirty-fifth year of Hammurabi, 2632 B.C., six, though it rose again to twelve by the eleventh year of Nabonidus, 544 B.C.

Since the earliest days gold had been in much demand for personal ornaments and for making cups and bowls, and a plentiful supply of this metal was found in the death-pits at Ur. Some of the monarchs in Mesopotamia, Egypt and elsewhere seem to have believed that the possession of gold was of the greatest importance, and they

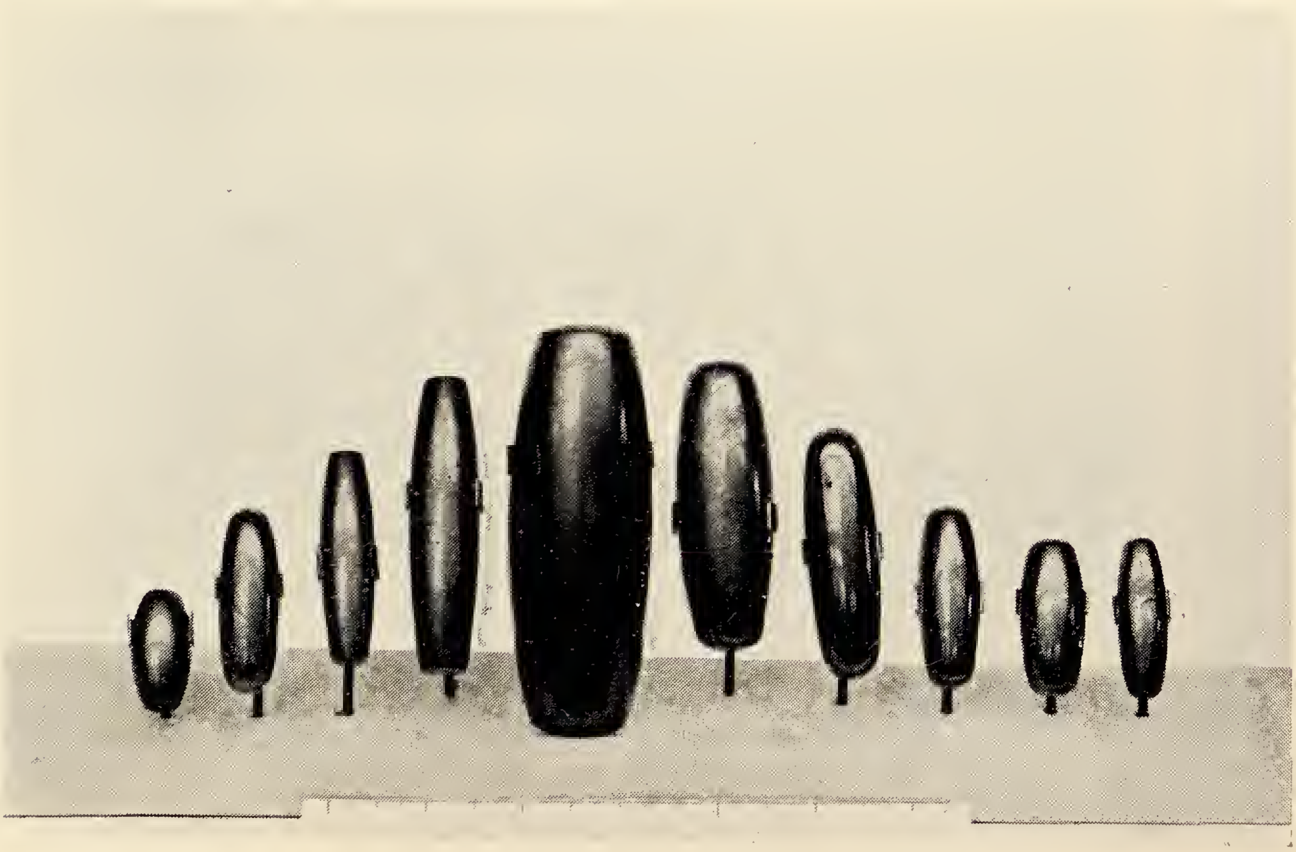
retained a great amount among their personal possessions and had it buried with them at their deaths, thereby giving rise to a number of tomb-robbers, and in Egypt to a still larger number of cemetery guards. It was the Greeks, a great trading people given to clear thinking, who seem first to have realised that the chief value of gold was as a means of exchange, and that it had little or no value except for what it could purchase. It was to point this moral that they told the story of Midas, a king of the Phrygians, who had discovered the gold deposits in Mount Pangaeum, for they said of him that at his request the gods had ordained that everything that he touched should be converted into gold. This delighted that Phrygian monarch, but when he helped himself to food this too turned to gold, so that he perished miserably of starvation. The same truth was expressed later in more prosaic fashion by Aristotle, who wrote that wealth consisted not in accumulating money, but in using it.

As civilization spread to the West, so trade increased in the Mediterranean at the expense of that in the Persian Gulf, and the Sumerian colonies in Asia Minor became more flourishing than the parent cities in Mesopotamia. With the advent of the Kassite kings in the latter country in 1746 B.C., trade there came almost to a stand-still, and this was further ruined by the destruction of the Indus Valley civilization about 1500 B.C., by the invading Aryan hordes. Matters became so acute that about 1375 B.C. Burna-Buriash, the Kassite king of Babylon, had to appeal to Amenhotep IV, the king of Egypt, to send him some gold, which was, he said, as sand in that country.

With the downfall of the Hittite empire about 1200 B.C., trade came mainly into the hands of the Greeks, the Phœnicians and the Lydians, and one suspects that the Sumerian colonists moved into the territory of the latter



a. The Ram caught in a thicket, from an early Sumerian Tomb



b. Sumerian weights

PLATE LXVII. THE RAM CAUGHT IN A THICKET AND SUMERIAN WEIGHTS

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Plate LXVIII. Predynastic Marble Bowl

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people. Gold and silver were becoming scarce, since much of it had been buried in the tombs of kings, and only a small portion of this had been recovered by the tomb-robbers. Trading parties, like the Argonauts, set out in all directions to search for fresh goldfields, but at last one was found nearer home by the discovery of gold nuggets in the River Pactolus, a small stream that ran past Sardis, the Lydian capital. On the strength of this discovery Gyges made himself king of Lydia, and his wealth descended in due course to Crœsus, who was considered the richest man of his time.

Since gold and silver were the chief medium of exchange it was necessary to weigh them each time that business was transacted. For this purpose the Sumerians had at an early date adopted a set of weights, based upon a unit known as the Mina, weighing 1 lb. ¼ oz., which was divided into sixty shekels, while sixty minae made up a talent. Weights based on these soon came into general use, but, since it was not always convenient to carry scales with one, it became customary to have ingots of known weight, though there was no guarantee that the weight was accurate.

To remedy this uncertainty in the weight of ingots a king of Lydia, the Greeks said Gyges, in the seventh century decided to make certain pieces, with a mark guaranteeing the purity and the weight of the metal. Having tested and weighed the lump, and proved it to be of the required purity and weight, they placed it on an anvil and struck it with a hammer, on which a special design had been incised. Thus coins came into existence, especially for international trade, and the Greek cities soon struck a number, mostly in silver, embossed with very beautiful designs.

CHAPTER XXII

WEAPONS OF WAR

As we have already seen in the chapter on the hunter's weapons, our earliest predecessors, if they desired to kill one of their fellow-men, employed the weapons that they used for the slaughter of their game. It has been stated that men, while in a hunting condition, were essentially peaceful, that among them wars were unknown, and that such methods of settling disputes did not come into vogue until men possessed property about which to fight. Our knowledge of the practices of people still in the hunting stage, or who were hunters in recent years, does not support this contention, for the Australian aborigines waged constant wars among one another until, and even after, the arrival of the white settlers, while the bloodthirsty campaigns waged between the rival bands of Indians upon the plains of North America are so well known as to need only a bare mention here. It is true that, so long as the people were not too thick upon the ground and game was plentiful, hunters preferred to exercise their skill in the slaughter of animals, whose carcases provided them with food, rather than undertake an unprofitable attack upon their fellow human beings. When, however, the supplies of game were scarce, wars, even of some duration, broke out between rival bands of hunters, each anxious to obtain a monopoly of the richest game preserves. Nevertheless such wars were usually neither frequent nor prolonged, there was no high degree of organisation, and no special weapons were required other than those in daily use.

It has already been pointed out that, as the last Ice Age was passing away, thick woodlands spread over the greater part of the temperate zones, in the northern hemisphere. As a result of these changed surroundings, the more active of the Palæolithic hunters moved away to those regions in which, owing to lack of rainfall or to the porous nature of the soil, the woodlands had not taken hold. Their less active fellows remained behind, by the seashore or by the banks of lakes and rivers, picking up such food as lay ready to hand, nuts, berries, roots, limpets, clams, mussels and oysters, and occasionally fish. Thus mankind became divided into two types, the one active and engaged in hunting, the other more sedentary and rapidly becoming mere food-collectors.

In most parts of the Old World the active hunters gradually became pastoral communities engaged in driving herds of cattle or tending flocks of sheep and goats. Only in the outermost parts of this continental mass did any remain in a purely hunting condition. The more sedentary food-collectors developed in various ways. In some parts, where wild grain-bearing plants grew at will, the more industrious of these developed agriculture and carried this practice by slow degrees over most of the Old World. Many of those living by the seashore began to exchange goods with others so situated and developed into traders, and became in time merchants and captains of industry. Others continued as food-collectors, some in remote districts remain in that condition to-day, but the majority were gradually incorporated into agricultural and industrial communities, where, it would appear, they succeeded in holding their own with difficulty.

The true food-collector had too little leisure or energy to indulge in war, and even when incorporated in a more advanced community shows little desire or aptitude for it. The grain-grower is usually too much absorbed in

cultivating his land to have any interests outside it, and such fights as he indulges in are not of his seeking. Though the most peaceful and long-suffering of men, they resent ravages on their fields, and even in quite early days seem to have come to blows with the pastoral tribes on their borders, whose beasts invaded and devoured their growing crops. We have a hint of one such episode in the story of Cain and Abel, told by the partisans of the latter, so that in the story as it has reached us no mention is made of the damage done by Abel's sheep among the crops of Cain. The grain-grower is usually a most peaceful person, but in some districts, where the crops ripen early, he has much leisure between harvest and seed-time, and then disputes arise between neighbouring villagers, often with tragic results. These, however, are more common in mountain regions, where the people are in reality more pastoral than agricultural.

Those who took to trade were not anxious to get on bad terms with their customers, and feared the loss of their goods and their profits should war break out. The early traders were, therefore, most peaceable folk, though as their wealth increased they were not averse to wars that would bring them fresh markets, or would result in the acquisition of fresh territory holding valuable commodities. Still the traders were not too keen to fight themselves, and preferred to organise wars where the actual fighting was undertaken by other members of the community. In spite of this two Sumerian cities, Lagash and Umma, though only a few miles apart, engaged in constant wars about a piece of land called Gu-edin, that lay between them, as early as 3000 B.C.

With the pastoral folk it was different. These moved about in large bands, pasturing their flocks and herds wherever an ample supply of grass was to be had, and there was keen competition for the earliest grass in the

spring and the latest in the autumn. In dry seasons they might have to go far to find suitable pasturage, and it was always possible that some other band had forestalled them. Then a fight ensued, such as occurred between the dependants of Abraham and Lot. Being a hardy and active crowd neither party would be averse to a skirmish, and so this type of warfare became the rule rather than the exception among pastoral peoples.

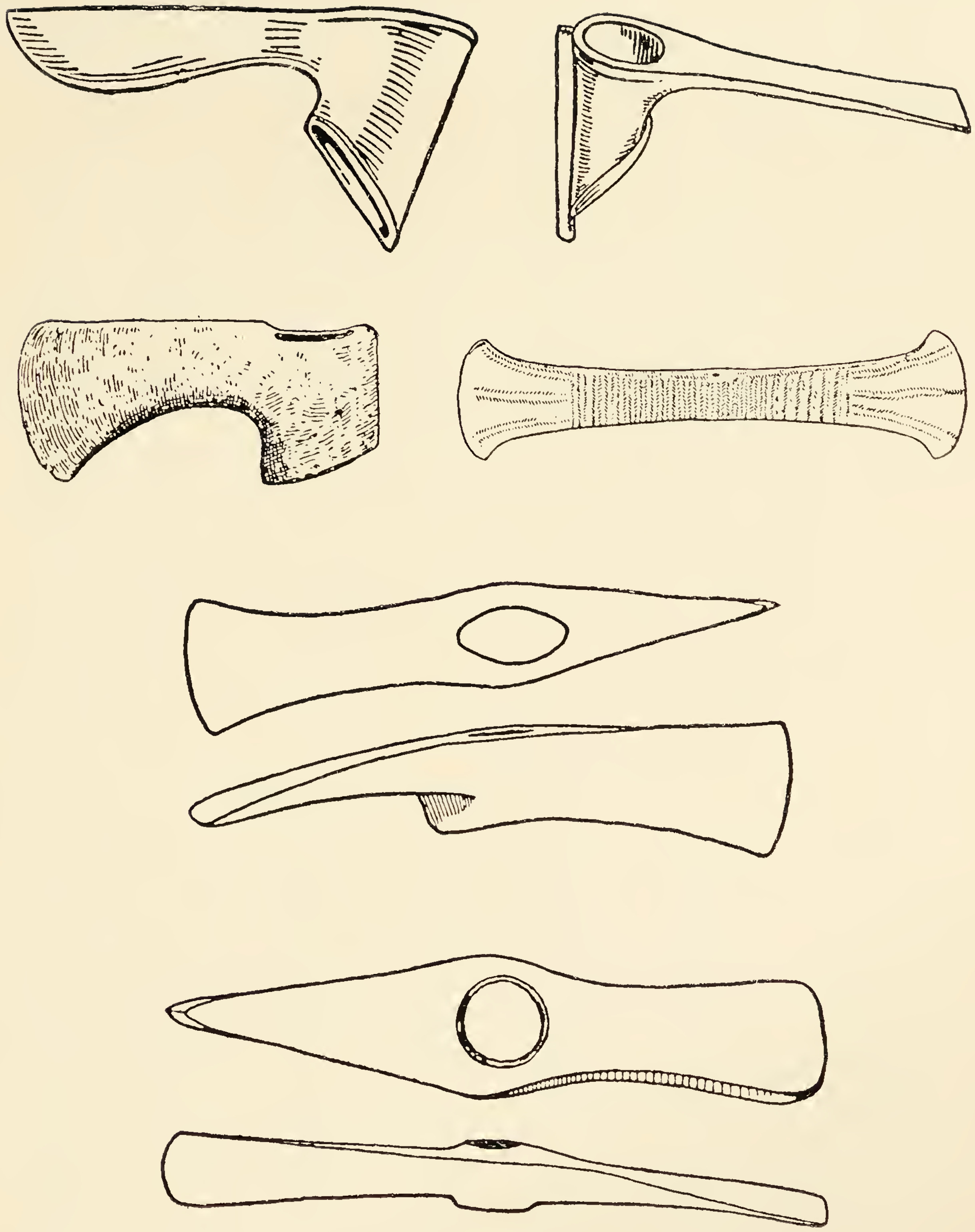
It is thought by some people that at intervals the rainfall on the grasslands diminishes for a time, resulting in a reduction of the herbage, and that on these occasions the pastoral peoples of these steppes have over-run the settled agricultural communities on their borders. This was noted as early as the fourteenth century of our era by the Tunisian historian, Ibn Khaldun, who, however, attributed the invasions of the nomads to the degeneracy of the city dwellers produced by excessive luxury. We now have evidence that such invasions have occurred in many occasions, some of them well before 3000 B.C., and these events seem to have been periodic occurrences every few centuries since about 2600 B.C. These are the first evidences of war that we possess, and, since the earliest of these on a large scale occurred not long before the beginning of the true Bronze Age, it is to that period that we must look for the development of weapons of war as distinguished from those of the chase.

During the Copper Age daggers of copper were used in Egypt, Mesopotamia and the Ægean Islands; in Egypt maces were used for fighting in Predynastic times, and one used in this way is depicted on a slate palette of Nar-mer, who is believed to be the same as Menes, who first united Egypt into one kingdom about 3400 B.C. Mace-heads are first found in the Middle Predynastic or Gerzean period, and they are believed to date from a much earlier time in Syria and Mesopotamia. Copper

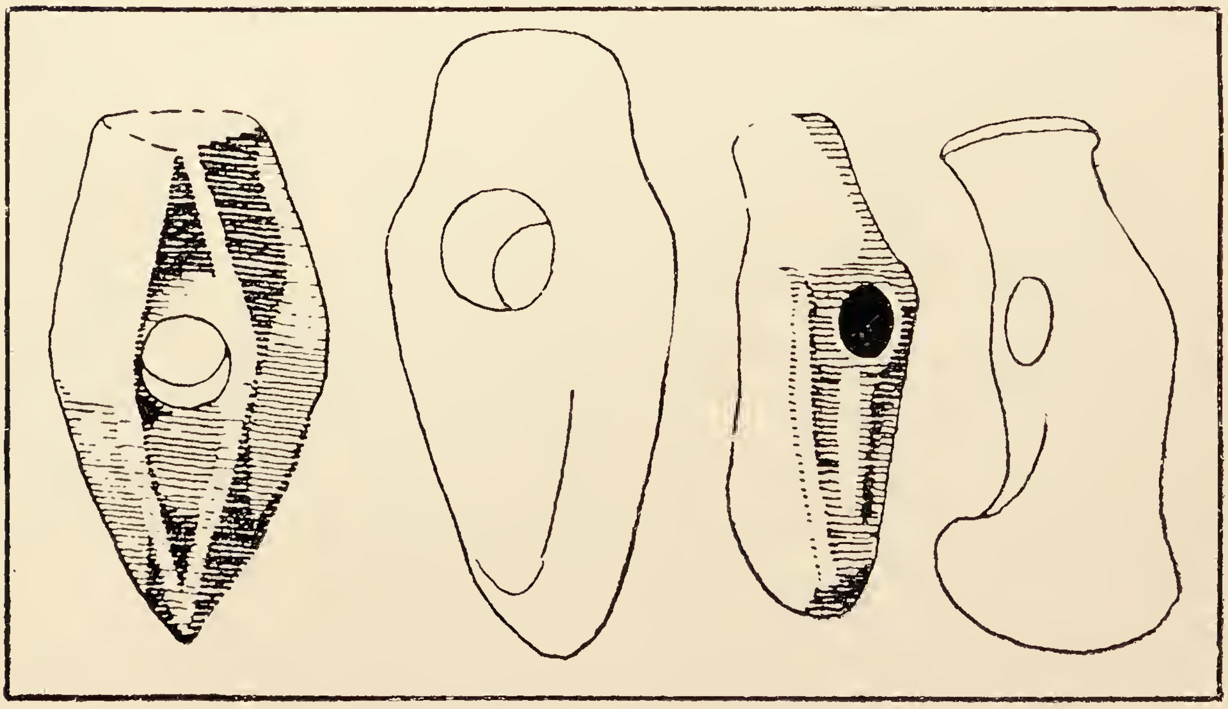
spear-heads appear early in Mesopotamia, and were known in Egypt as early as the First Dynasty; in the former country they were made with a tang, which was driven into the end of the shaft, but in the latter the tang was broad and thin and was wrapped round the shaft. Copper axes and adzes were known at an early date throughout the Near East, but we have no direct evidence that they were used as weapons of war in Asia. On a fragment of a stone vase in the Berlin Museum, the style of which suggests the close of the Predynastic period, is depicted a man, driving before him a prisoner, whom he is threatening with a copper axe,

In Mesopotamia the copper axe developed in many ways, especially into a double axe; this tool often had an axe-blade on one side and an adze-blade or a hammer on the other. Doubles axes of this type seem to have spread over large parts of Western Asia and to have reached the Koban district in South-east Russia, where more than one have been found. Whether they were used there as tools or weapons is uncertain, but it has been suggested with great plausibility that they were copied in stone by the pastoral people of the Russian steppe, and by them used as battle-axes. Stone battle-axes of this type were dug up in the second city on the site of Troy, and have been found stretching from South Russia to the shores of the Baltic Sea, where they developed into certain well-known types, and whence they were carried over a great part of North-west Europe. These stone battle-axes or axe-hammers, it is thought, were brought to the north by the worshippers of Thor, who is always spoken of as wielding a stone hammer.

The stone battle-axe was almost the only warlike weapon used in the Neolithic Age in North-west Europe, and it did not spread far westward from the Baltic Sea until bronze was coming into use in the West. Another

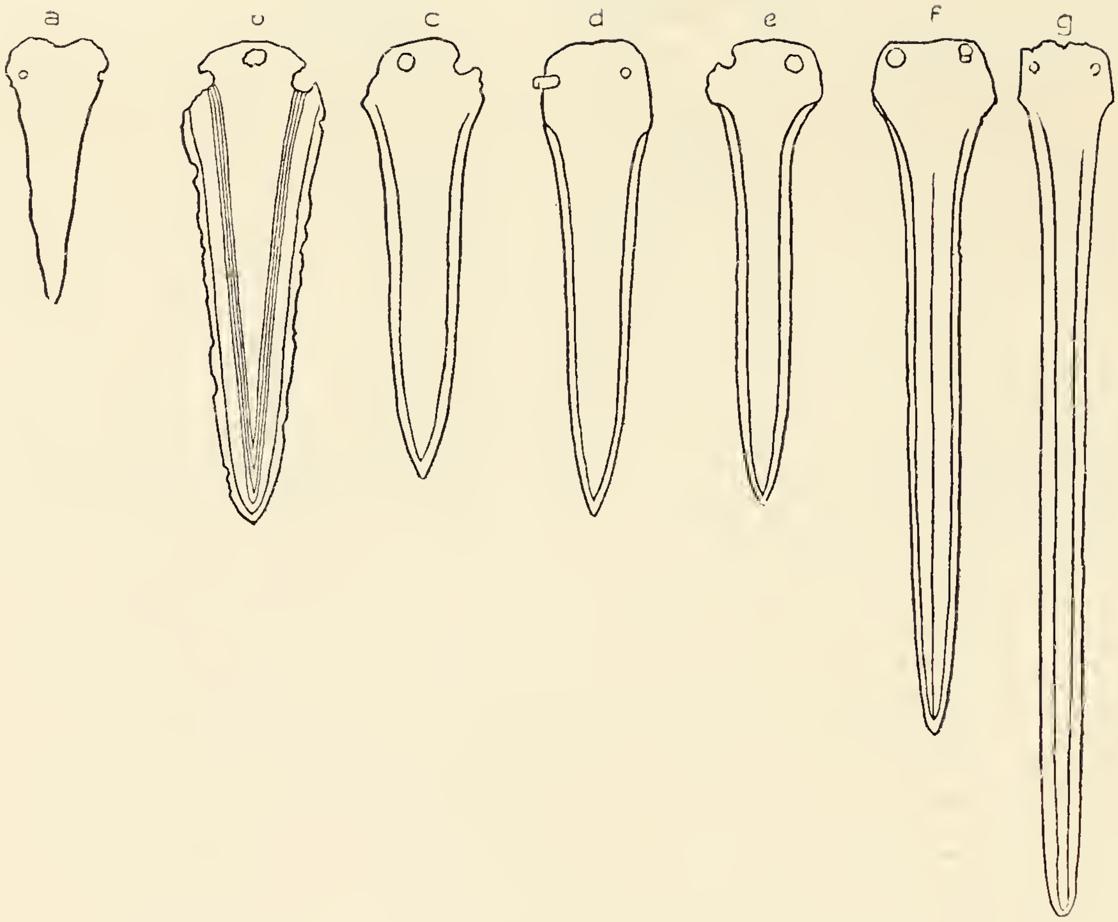


a. Copper axe-heads

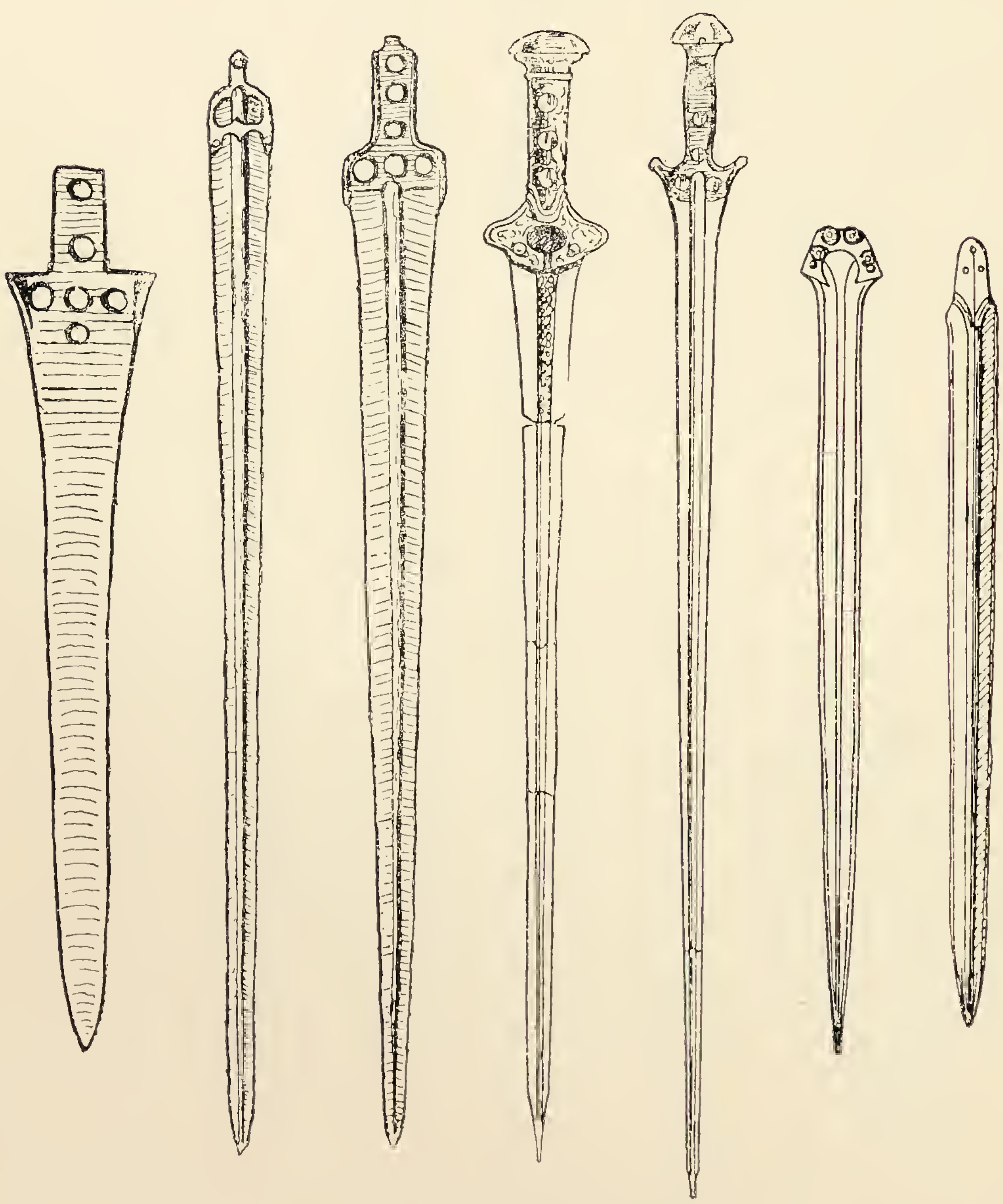


b. Perforated stone axe-hammers

Plate LXIX. Stone and Copper Axe-heads



a. The evolution of the bronze dirk



b. Bronze dirks from the Mediterranean

PLATE LXX. BRONZE DIRKS

implement, which could be used as a warlike weapon if need arose, though its proper function may have been peaceful, was the finely chipped flint knife or dagger, which is found associated with the stone battle-axes in the Baltic lands, but which seems to have reached this country before the Neolithic Age was over.

During the Early Bronze Age a great many experiments were carried out with a view to improving the use of tools, since more varied forms could be produced now that the metal alloy could be run into closed moulds. Along with these new types of tools came a distinct development in weapons of war, which from now on became more distinct in form from tools and weapons of the chase.

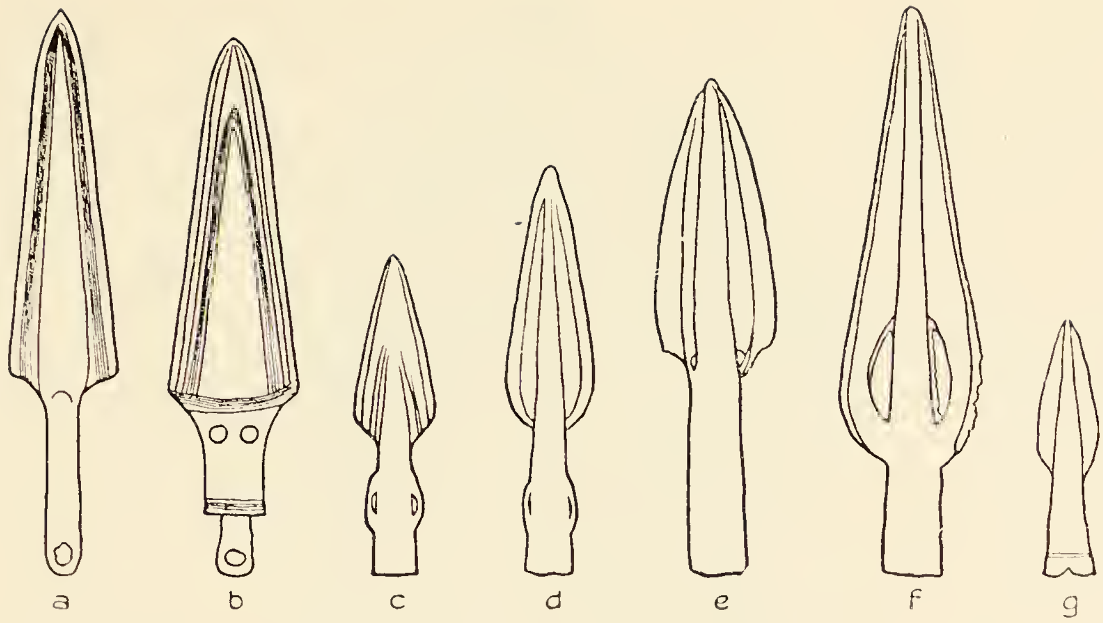
At the beginning of the Bronze Age the chief weapon in use was the dagger. This was sometimes fitted with a tang, which could be driven into the handle, but more frequently it was of triangular form and the handle was attached to it by a series of rivets. This form arose in the Eastern Mediterranean in the Copper Age, but as the use of bronze became more general the daggers became longer and the butt ends narrower. As the daggers grew longer it became necessary to give them added strength, and they were cast with a mid-rib down the centre. Towards the close of the Early Bronze Age some of the daggers assumed an ogival form, but later on the sides became nearly parallel, the butt-end diminished in size and became trapezoidal in shape, while the rivets were reduced to four. Such daggers or dirks, as they may more correctly be called, continued to increase in length until they became the length of swords; these long dirks are sometimes called rapiers, though the use of this term is to be deprecated, since they were quite rigid.

The dirks became longer and stouter in the Mediter-

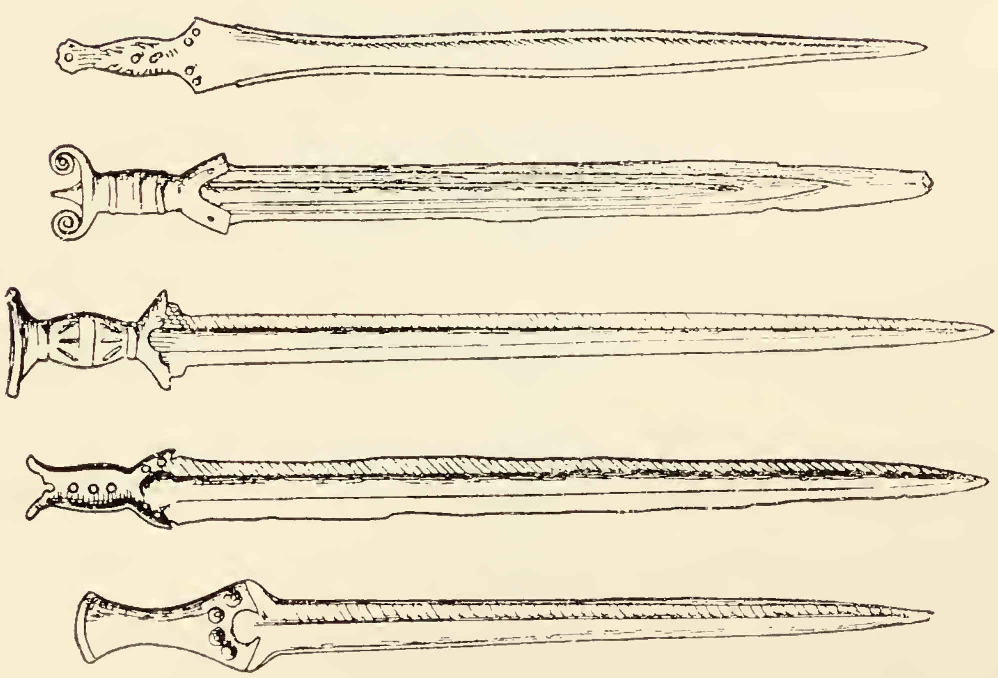
ranean lands, especially in Greece and Crete, and this placed a strain upon the rivets by which the blade was affixed to the hilt, the whole weapon was cast in one piece, but on either side of the hilt were flanges, between which could be attached pieces of bone or wood.

The idea of a flanged hilt or tang, cast in one piece with the blade, spread from the Ægean to Central Europe, at this time dominated by cattle-men from the Russian grasslands, who had tamed the horse and were accustomed to cavalry fighting. These people were developing a slashing sword from the large daggers that they had used hitherto, and they made these with flanged tangs as in the Ægean. These swords were usually heavily weighted half-way down the blade, and often took a leaf-shaped form, though in some cases the sides remained parallel and came suddenly to a point at the end. The blades were, however, always broader and heavier than those of the dirks, which had been intended as thrusting weapons. The blades and hilts of these swords passed through a variety of forms, and gave way gradually to steel weapons after men had learned to forge iron.

In the Early Bronze Age, when the dagger was the only weapon for offence, it was felt that its lack of length was a disadvantage, for it could only be used at short range. In the West of Europe experiments were made to overcome this difficulty by fixing the dagger blades at the ends of poles. The first attempt to do this was by fixing the blade at right angles to the staff. This was first developed in Spain and the South of France, but the idea spread up the Atlantic coast to the British Isles and was well developed in Ireland. From some rock-engravings in the Ligurian Alps one must conclude that the poles were long, but there are other reasons for believing that the blades were more often attached to short staves, about the length of axe-handles, which was



a. The evolution of the spear-head



b. Bronze swords

PLATE LXXI. BRONZE SPEARS AND SWORDS

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Plate LXXII. Bronze Halberd

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certainly the case with similar implements used at a later date in China. These weapons are usually called halberds, but dagger-axes would really be a more appropriate name.

The other way of obtaining a greater length for the dagger was to fix it on to the end of a shaft so that the axis of the dagger and the shaft were the same. Thus was produced a spear. The earliest spear-heads had a tang which was driven in to the end of the shaft. By fixing the head on this way, the shaft sometimes became split, and it was necessary to bind the end with thongs or metal bands. To obviate this, it occurred to someone to cast a bronze ferrule, which could be attached with rivets to the shaft and spear-head. This method had only been in use for a very short time when someone thought of casting the spear-head and ferrule in one piece, then the tang was omitted and a socketed spear-head produced. It is interesting to us that this invention took place in England, where alone all the stages in its development have been found. This was first discovered by the late Canon Greenwell, who traced the evolution of the bronze spear-head in this country from its inception to its latest form.

Such were the chief weapons of offence used in the Neolithic and Bronze Ages before the iron sword replaced them. Spear-heads of bronze seem to have continued in use somewhat later, for at first it was difficult to make these of iron, but before the beginning of our era these difficulties had been overcome, and beautiful iron spear-heads, sometimes decorated with bronze, were produced in this country before it was conquered by the Romans.

Defensive appliances were less common in early days, or perhaps, as in Crete, they were made of leather, stretched over wicker-work. In the last phase of the

Bronze Age circular shields or targets of bronze came into use. These were made of very thin sheets of bronze, probably beaten over wood or leather. They are usually decorated with various forms of geometric ornament. Towards the close of the Early Iron Age much more beautiful bronze shields were made in this country. These were oval in shape and are often covered with elaborate decorations including enamelled bosses.

It will be seen from the brief description of warlike weapons given above that fighting was always hand to hand and at close quarters in early days, except where bows and arrows were used, and these do not seem to have been extensively employed in warfare, except among the Egyptians, the peoples of Asia Minor, and in later days the Scythians and the Parthians. Fighting was, therefore, at close quarters until the battering-ram and the catapult were invented and these were used little except for besieging fortresses. The days of open fighting, with combatants ranged at considerable distances from one another, is a relatively modern development, only made possible by the introduction of gunpowder in the fifteenth century of our era.

CHAPTER XXIII

THE FORGING OF IRON WEAPONS

As we have seen, gold, silver and copper were worked in very early times, and long before 3000 B.C. men had learned to cast objects, often of intricate design, in these metals, while by 2000 B.C. bronze, an alloy of copper and tin, was being cast for tools and weapons in the Near East and over most parts of Europe. It may appear strange, therefore, that iron did not come into use for such purposes until a much later date.

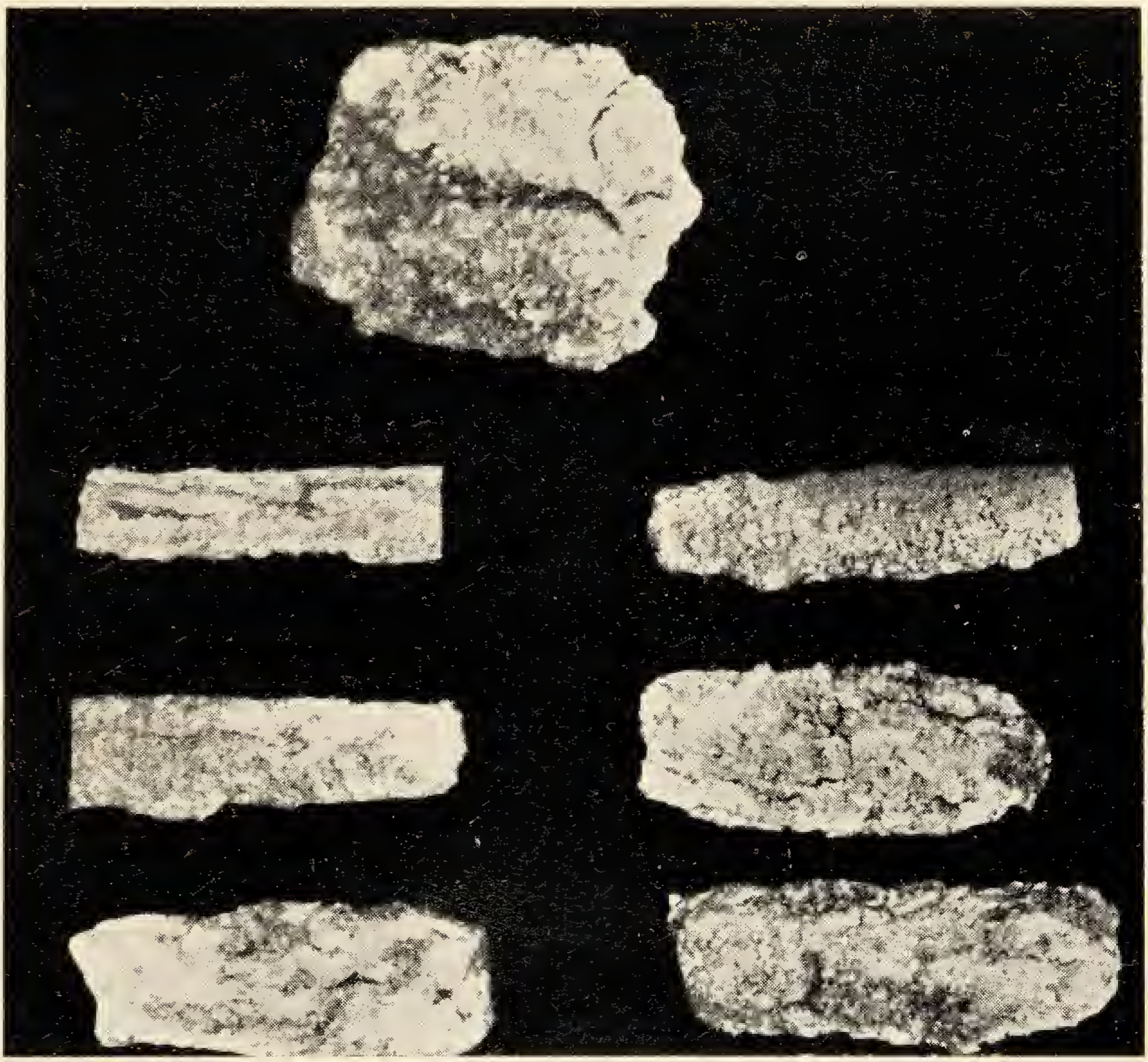
Iron is perhaps the commonest metal to be found and it occurs in a pure form in many meteorites and as telluric native iron. In the latter form it is usually found in basalt and other rocks, but almost always in grains or in nodules too small to be of practical use. At Ovifak, in Greenland, however, it occurs in masses, and here it has been used by the Eskimo for tools and weapons. Meteorites consisting mainly of iron are found more commonly in America than in the Old World, but they are met with sometimes in the eastern hemisphere, where they invariably contain a high percentage of nickel. If they are heated in the fire to a sufficient temperature they can be worked by hammering, but a great deal of labour must be expanded upon this form of iron if it is to become serviceable for tools, as without a great deal of hammering it remains a spongy mass.

The metallic nature of such meteorites was recognised at a fairly early date, for a few objects have been found that are clearly of this origin. The first to be discovered were some iron beads, taken from a predynastic tomb in

Egypt by Mr. Wainwright in the winter of 1909-10. The spongy appearance of these beads suggested at once that the metal was of meteoric origin, and an analysis made a few years ago showed that they contained a high percentage of nickel, thereby confirming the original suspicion. At Ur Mr. Woolley found in one of the death-pits, to which reference has already been made, several fragments of iron, much corroded, which appeared to be the remains of a tool. These also have been analysed and found to contain much nickel, so we may confidently ascribe to the metal a meteoric origin. Several other early fragments of iron objects have been recorded. Among these is a piece of iron found in an inner joint of the great pyramid: if this had been placed there when the pyramid was being built, it must date from soon after 2900 B.C. Several pieces of an iron pick-axe were found at Abusir, in a settlement dating from the Fifth Dynasty, and a spear-head of this metal, said to date from the Twelfth Dynasty, was discovered in Nubia. Some doubt is felt about the dates of these three pieces, for these discoveries stand alone, and none of them have been analysed, so that we are unable to say whether or no they were made of meteoric iron.

It seems, then, that well before 3000 B.C. men had discovered some value in meteoric iron, but had not yet realised that constant hammering was required before it could be converted into a substance of real value for tools and weapons; they had not recognised the value of other ores, that could be more readily worked, and so a long time elapsed before this metal came into general use.

Rich iron ores are to be found in many parts of the world and among these are some iron-stones, which have a somewhat metallic appearance, that might easily have attracted the attention of early man. Three such beds, of immense size, may be mentioned. One of



a. Iron beads from a predynastic tomb in Egypt

b. Iron dagger from the tomb of Tutankhamen

PLATE LXXIII. EARLY IRON OBJECTS

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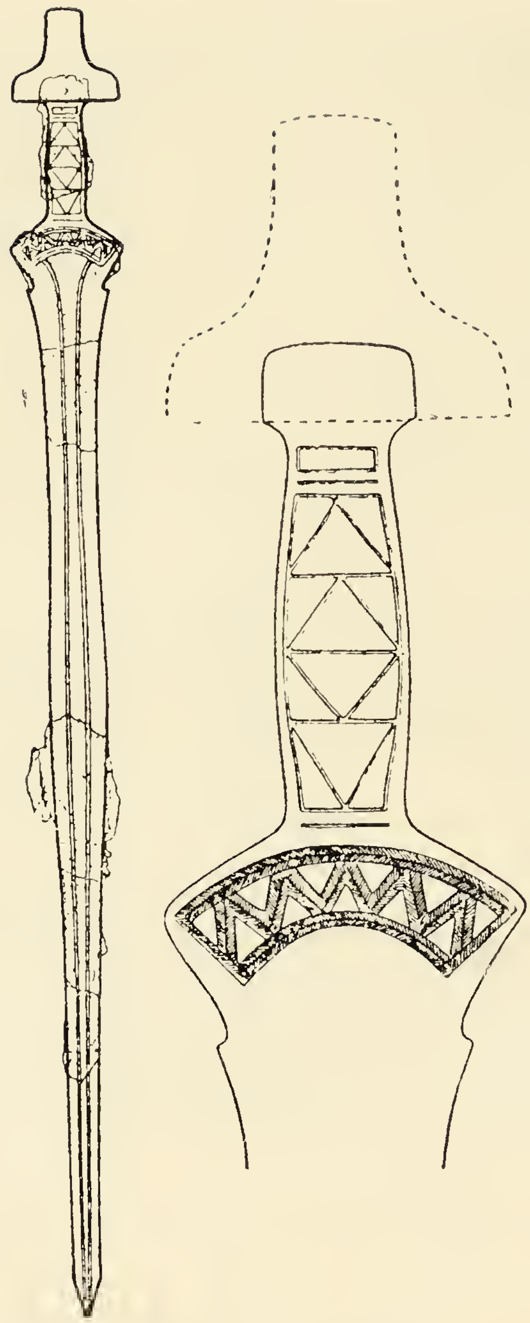

Iron sword from Hallstatt

Plate LXXIV. Early Iron Objects

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these lies in the Rhaetic Alps, in the neighbourhood of Klagenfurt, where there is a whole mountain composed mainly of iron ore; two others lie in Asia Minor. One of these lies on the south-east corner of the Black Sea and comprises a series of mountain ranges not far from the coast extending from Yeshil Irmak to Batum. The iron deposits lie scattered along the lower slopes and foot-hills of these ranges, the western parts of which are cut through by the River Halys. The last region lies in the Taurus and Anti-Taurus districts, stretching from Cape Anamur to the borders of Syria, and again near Aleppo, the Lebanon and the Euphrates. One of these was probably the area in which iron was first worked.

The earliest known object of iron, other than those already described, comes from the tomb of Tutankhamen, so wonderfully discovered by Mr. Howard Carter and opened by him and the late Lord Carnarvon. This tomb is known to date from about 1350 B.C., and from its design and workmanship the dagger is evidently a foreign product imported into Egypt. While excavating at Gerar in Palestine, Sir Flinders Petrie discovered in a deposit, that is about the same age as Tutankhamen's tomb, a few tools of iron, but articles made of this metal were scarce, as though the commodity had only been recently introduced. This discovery, however, indicates the direction from which iron first reached Egypt. Less than a century later, some time before 1255 B.C., Rameses II, the king of Egypt, sent a letter to Hattushil, the king of the Hittites, with a request for a supply of iron goods. The Hittite monarch replied that he was unable to accede to this request, as there were no such goods at that moment at Kissuwadna.

It is clear from this correspondence that even as late as the time of Rameses II iron goods were not being produced in Egypt, but that the land of the Hittites was

looked upon as the main, if not the only, source from which they could be obtained. The reply of Hattushil has been interpreted by some as implying that Kissuwadna was the principal centre of the iron industry, while others have suggested that it was a port on the south coast of Asia Minor from which iron goods were exported. It seems clear, however, that Kissuwadna did not lie on the coast but somewhere inland, probably to the north of the Taurus range. Here, as we have seen, there are deposits of suitable iron ore, and it is quite possible that in the time of Hattushil these deposits were being worked. There are good reasons, however, for believing that it was not in Kissuwadna or the Taurus region that the earliest attempts at iron working were made.

Let us now approach the subject from another angle. The Greeks had a word for iron, *sideros*, which really means "from the stars," and clearly indicates meteoric iron; this shows us that at one time they had made attempts to use this material, as had the Predynastic Egyptians and the people of Ur, or else that they had translated the Egyptian word for iron, which has the same meaning. This is the only word for iron used by Homer. In later days, however, they had another word for steel, *chalybs*, which is a word of foreign origin. This word *chalybs* naturally reminds us of a people, known to the Greeks as the Chalybes, a tribe living near the south coast of the Black Sea to the east of Paphlagonia. The name Chalybes reminds one of Alybe, mentioned by Homer, a district which was just beyond Paphlagonia. Both names seem to be the equivalent of the Hittite word *Khalewa*, which is interpreted to mean the people of the Khale or Halys basin.

It will be remembered that one of the areas, rich in easily worked iron, lies in several mountain ranges cut through by the lower course of the Halys river, and this

suggests that it was these people of the Halys, the Chalybes or Khalewa or people of Alybe, that were the earliest workers in iron. Their territory lay only just north of Khattussas or the modern Boghaz Keui, the capital of the Hittite empire, and they may well have been one of the tribes that were subject to this conquering people. In any case, since the iron deposits lay so close to the Hittite capital, this warlike people would doubtless have obtained from them by force or barter such iron or steel weapons as they needed. At an early date the Hittite empire extended to the Taurus and into Syria, and doubtless they exploited in due course the iron mines of those regions. Kissuwadna was, however, a province conquered at a relatively late date and seems to have been at all times somewhat unruly, so it would be unwise to assume that the iron deposits there were either the earliest or the most important to be worked in the Hittite empire.

How early the Chalybes had discovered how to make use of the rich deposits lying in their foot-hills is uncertain, but as a very fine dagger, mounted in a gold hilt, was exported to Egypt before 1350 B.C., it cannot have been much later than 1400 B.C., and might well have been considerably earlier.

For a long time the Hittites had a monopoly of this industry, though a little later there were furnaces in South Palestine, as Sir Flinders Petrie has shown. About 1200 B.C. the Hittite power suddenly came to an end, probably as a result of an invasion by the Phrygians, a hardy race of mountaineers from Macedonia or Thrace, who had crossed the Dardanelles a generation or two earlier. The iron-producing regions in the Halys Valley now came under Phrygian rule, but these people appear to have had little commercial aptitude, and it seems likely that the iron and steel products were marketed by the Lydians, and carried over-sea by the Phœnicians

and Greeks. By whatever means they were carried, iron swords soon became common around the Eastern Mediterranean, and before 1000 B.C. had been carried by sea to South Italy.

A little later we have evidence of an iron industry in Central Europe, which seems to have been well established there by 900 B.C., and, according to some authorities, earlier. How the knowledge of iron working reached this area is uncertain. It may have been carried through Italy, or up the Adriatic Sea, or possibly it arrived there by another route. Some graves have been found in the Koban district of South Russia, just north of the Caucasus Mountains, the earliest of which contained bronze swords of a type well known in Central Europe a little before 1000 B.C., while in some of the later graves are weapons of iron. These people no doubt derived their knowledge of iron from the folk living south of the mountains, who would have been dwelling near the eastern end of the iron-producing mountains. It is possible that these people of the Koban Valley kept in touch with their kinsmen in Central Europe, and that through them the knowledge spread.

By whatever route it came the knowledge had reached Central Europe not later than 900 B.C., and no time was lost in exploiting the resources of the Rhaetic Alps and the mountain of iron-stone that lies on the south of the River Save. Iron swords spread gradually over most parts of Europe during the next two centuries, and by 500 B.C. there were few parts of Europe in which iron was not being used and worked.

Thus we see that, in spite of a few not very successful experiments with meteoric iron ore, the knowledge of how to produce really effective iron goods was not acquired until about 1400 B.C. This seems strange when we remember that gold and copper, and perhaps silver,

too, were known over a fairly wide area in the Near East as early as 5000 B.C., and that copper tools were being cast certainly well before 4000 B.C. The cause for this delay in the use of a metal, now more generally used than any other, merits inquiry.

We have seen that meteors containing a high content of iron are not found so plentifully in the Near East as in some parts of the world, and that other iron ores are not quite so obviously metallic as gold and silver and some of the ores of copper. These factors alone would naturally have delayed the recognition of this metal. Again gold, silver and copper are found native, and the processes of working them were probably discovered before copper was smelted from its ores. When this had been achieved it would have been natural to apply the same process to iron ores, but this would not have been effective. It is true that iron can be worked without using any greater heat than is necessary with copper, in fact a slightly lower temperature will suffice. Whereas, however, the molten copper can be readily run into moulds, the casting of iron is a much more difficult process, that was not achieved until very much later days. Iron to be worked easily has to be heated sufficiently to be soft and malleable, and then to be beaten upon an anvil with heavy hammers until the impurities scale off. Hammering, it is true, had been used for gold, silver and copper, but, since these metals are soft, no very great labour had been involved and no large or heavy hammers had been required. It was different in the case of iron.

Hammers were little used in early days, since a spherical stone had always sufficed for that purpose, and only small light hammers were needed for working gold and silver. To make a sledge-hammer involved boring a hole in a fairly large and thick stone, so as to hold a long and fairly stout handle. Such stone hammers were

first made by the cattle-men of the Russian grasslands between 3000 and 2000 B.C., but, though these often had a hammer on one side, the other was shaped like an axe-blade, and they were used for war. Such stone battle-axes and axe-hammers were little known to or used by early metal workers, and are more associated with a Neolithic stage of culture. By degrees the battle-axe men spread over most of Europe and made themselves felt in Asia Minor, and there is reason for believing that the governing class of the Hittites, who conquered the central plain of Asia Minor about 1900 B.C., were a section of these people. Thus the discovery of how to work iron by repeated blows from a sledge-hammer seems to have arisen after the battle-axe using Hittites had been settled by the side of the Chalybes in the midst of the most suitable iron ore, if, indeed, the Chalybes were not themselves Hittites, which is possible.

The knowledge of iron working was the last of the great discoveries of antiquity. From then on no important new material came into use until the scientific discoveries of the last century and a half. This discovery inaugurated the Iron Age, in which all tools and weapons were made of this metal, and, since this is still in general use, we are living in the Iron Age to-day. Except for the utilisation of water and wind power, used mainly for mills, no striking new discovery was made. The great developments of the ancient world consisted in developing the discoveries already made to their highest uses, and water and wind power only came to be substituted for man power as slaves were becoming scarce when the Roman civilization was giving way to barbaric tribes, who had come from the grass-lands and deserts. No advances in material culture were made during the Middle Ages, and the features that distinguish modern civilization from ancient are due to discoveries made during the last four centuries.

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